PRIVATE AND SOCIAL COSTS OF HAZARDOUS MATERIAL TRANSPORTATION: A MODEL FOR ANHYDROUS AMMONIA DISTRIBUTION IN NORTH DAKOTA

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Private and Social Costs of Hazardous Material Transportation:
A Model for Anhydrous Ammonia Distribution in North Dakota

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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ABSTRACT

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The transportation of anhydrous ammonia, which is classified as a hazardous material, poses risk to the transporter, surrounding communities, and the environment. The commercial transportation of anhydrous ammonia is highly regulated, while the private transport is not subject to the same degree of mandates. Given the regulatory policies, the current locations of licensed dealers of anhydrous ammonia within North Dakota may be leading to a scenario where a private transporter has an incentive to disobey these policies and thereby expose him/herself, the surrounding communities, and the environment to unnecessary risk.

Three stylized counties were constructed to represent the attributes of the eastern, central, and western counties of North Dakota. Attributes included transportation infrastructure, population distribution, and crop composition. Mathematical programming techniques were then utilized to determine the number and optimal location of licensed dealers of anhydrous ammonia within these counties.

The results were then compared and contrasted with the current locations of licensed dealers throughout North Dakota to determine if the regulatory policies are sufficient in that they are not encouraging unsafe actions of the transporters and thereby endangering the transporters, surrounding communities, and the environment. The results indicated that the current regulatory structure associated with the transportation of anhydrous ammonia is sufficient to limit incidents.

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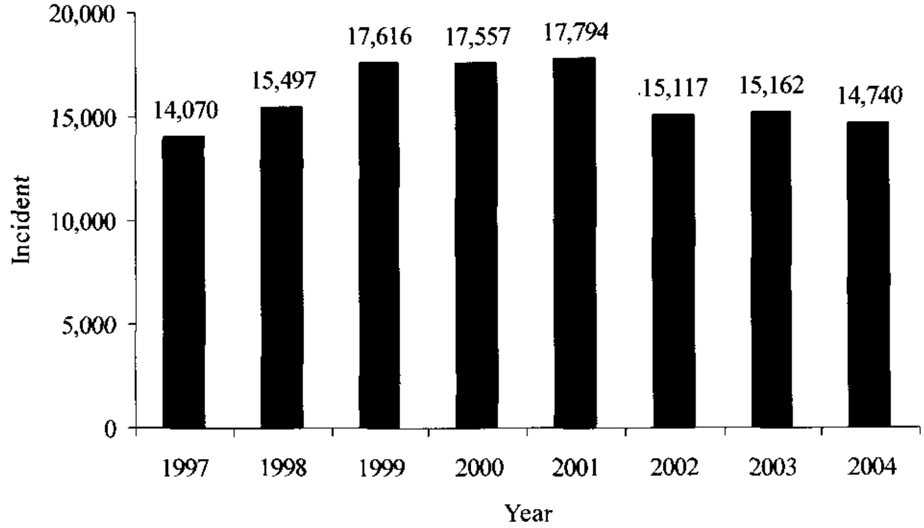
CHAPTER I

INTRODUCTION

A hazardous material is one that can pose imminent danger to the carrier and the surrounding communities through which it is being transported (USC, 1975a). The transportation of hazardous material (hazmat) has reached unprecedented levels recently. For example, there are at least 300 million hazmat shipments each year in the United States totaling approximately 3.2 billion tons of hazardous material (U.S. DOT, 2000a). From 1997 to 2004 there has been an annual average of 15,944 reported hazardous material incidents (Figure 1.1). A hazardous material transportation incident is any occurrence resulting in an uncontrolled release of materials, during transport, that pose risk to health, safety, and property as definied by the Department of Transportation Materials Transport regulations. Of the roughly 15,000 incidents related to hazmat transportation in 2004, in the United States, 461 were classified as serious incidents. These incidents resulted in 13 deaths, 118 injuries, and 38 million dollars in damages (OHMS, 2004b). The above statistics only include the reported occurrences. It has been estimated that 30 to 40 percent of reportable hazardous material incidents are never reported (Abkowitz and List, 1987).

Given the large number of hazmat shipments, there is the potential for catastrophic results with multiple fatalities, injuries, and severe environmental damages. For example, over 8 million dollars have been spent for environmental remediation, and damages have exceeded 2 million dollars for a 2002 anhydrous ammonia release of 146,700 gallons in Minot, North Dakota. This incident also resulted in 1 fatality, 11 serious injuries, and 322 minor injuries (NTSB, 2004). Due to the involuntary nature and possible magnitude of these undesirable consequences, one can conclude that a transportation infrastructure which considers these potentially dangerous scenarios while recognizing the costs associated with transport is required.



Source: Office of Hazardous Materials Safety (OHMS) (2004b).

Figure 1.1. Hazardous Materials Incidents, 1997-2004.

An incident involving the commercial transportation of hazardous material can result in devastating effects for all involved, thus the DOT and other federal and state agencies highly regulate its transport. However, these same regulations do not pertain to the private transportation of hazardous material, which raises the question, "Is the private transport of hazardous material under-regulated?" Such under-regulation would result in a potentially dangerous scenario to the transporter and surrounding communities. This paper will focus on the transportation of anhydrous ammonia, a hazardous material that is used in farming. Anhydrous ammonia was selected as it is a highly dangerous element, and it is frequently transported both commercially and privately throughout North Dakota.

The Code of Federal Regulations classifies anhydrous ammonia as a hazardous material. The Department of Transportation includes anhydrous ammonia in its top 50 hazardous materials in the United States (U.S. DOT, 2003c). The primary uses of anhydrous ammonia are as a fertilizer, for farming, and as a feedstock, for producing various chemicals. The material is a compound formed by the chemical combination of the two gaseous elements nitrogen and hydrogen. Nitrogen, and other elements essential to plant growth, must be restored to maintain soil fertility following the harvesting of fruit, vegetable, or grain crops (Dakota Gasification, undated). At room temperature, and normal atmospheric pressure, ammonia is a pungent, colorless, and lighter than air gas. The material is usually shipped as a liquid, since more material can occupy the same space in a liquid rather than as a gas. If a hose ruptures or a valve is unintentionally opened, the high pressure from a tank can cause anhydrous ammonia to spray out, possibly causing injury. When anhydrous ammonia comes in contact with water, the water and ammonia quickly combine. If ammonia comes in contact with the eyes, skin, or mucous membranes it will quickly cause rapid dehydration and severe burns. The respiratory tract and skin are easily burned due to their percentage of moisture. Victims exposed to even small amounts of anhydrous ammonia require immediate treatment with large quantities of water to dilute the compound.

When pressure is released, liquid ammonia quickly converts to a gas. This conversion will freeze atmospheric moisture, forming a white colored cloud. The temperature of the vapor cloud can range from -45° F to -100° F in the first 10 to 12 feet of the cloud, which may rapidly freeze everything it touches. Ammonia vapors will rise and easily travel with any wind present (Dakota Gasification, undated). In a study conducted by Klein et al. (1987), the most frequently mentioned agricultural chemical requiring hospitalization and emergency room visits from exposure in central Nebraska, was anhydrous ammonia. It was noted in one-third of all cases, and it was reported in over twice as many cases, as the second most frequently mentioned agent. The properties of anhydrous ammonia make it one of the most potentially dangerous chemicals used in agriculture.

Additional concerns have risen regarding the use of anhydrous ammonia in the process of making the illegal drug methamphetamine. Methamphetamine, or meth, is a powerful central nervous system stimulant with a high potential for abuse and dependence. It is illegally produced and sold in pill form, capsules, powder, and chunks. One simple recipe for making meth requires commonly available precursors, including anhydrous ammonia. The drug can be made in a makeshift "lab" that can fit into a suitcase. The popularity of this drug has resulted in farmers' ammonia tanks being tapped by "cooks", using anhydrous ammonia to produce methamphetamine (Agribusiness Association of Iowa, 1999). This concern has fueled the importance of strict regulations associated with the transportation and storage of anhydrous ammonia.

The commercial transportation of hazardous material is highly regulated by the Environmental Protection Agency (EPA), the Code of Federal Regulations (CFR), and the Department of Transportation (DOT). A brief sample of pertinent regulations includes stipulations that all shipments of hazardous material by commercial transport must be transported without unnecessary delay. A carrier may not transport a hazardous material by motor vehicle unless each of the employees involved in that transportation has received proper training. These regulations at the national level do not pertain to the private transportation of hazardous material. For example, a farmer transporting potentially hazardous material to his/her farm from a co-op or elevator would not be subject to these rules. In most cases, the state in which the material is being transported will have a specific set of policies, which the private transporter would need to obey. Some policies associated with the transport of anhydrous ammonia within North Dakota include: a farmer, rancher, dealer, or commercial fertilizer company employee may pull no more than two portable empty tanks and one full tank behind a farm tractor, pickup, or truck; the speed limit may not exceed 25 miles per hour, empty or full; and the overall length of the entire transporting unit may not exceed 75 feet (Maher, 1998). Additional policies are reviewed in Chapter II.

Given that the commercial transportation of anhydrous ammonia is highly regulated, and non-commercial transportation is not, there may be non-optimal under-utilization of commercial transport and over-utilization of farm transport. This would potentially lead to high risk of damages from hazardous material transportation, if farm drivers do not internalize the external risk of accidents. This under-utilization of commercial transportation would be a greater problem in the Northern Great Plains, where decreasing populations have led to a decreased network of dealers and agribusiness operations.

The regional network for the distribution of anhydrous ammonia in North Dakota consists of a number of licensed dealers. Licensed dealers receive anhydrous ammonia from manufacturers. From the dealer, the product can either be distributed directly to the farmer, or the farmer can travel to the licensed dealer and transport the product to the farm. The transportation of anhydrous ammonia involves costs and poses some risk to the transporter, surrounding communities, and environment. Whereas commercial transport is regulated, a farmer's transport is not easily monitored, which may result in a higher degree of risk. Therefore, the current configuration of licensed anhydrous ammonia dealers may not be optimal from a perspective of minimizing cost and risks to the transporter, surrounding communities, and the environment.

Objective of Study

The goal of this study is to determine if the current regulatory policies for the commercial and private transportation of anhydrous ammonia within North Dakota are resulting in a potentially unsafe scenario. Such a potentially unsafe scenario is one where a transporter has an incentive to disobey the policies, thereby exposing him/herself and the surrounding communities to unnecessary hazard. This goal will be achieved by considering the attributes of North Dakota, including its crop composition, transportation infrastructure, and population distribution.

Mathematical programming techniques will be utilized to determine the optimal configuration of licensed dealers of anhydrous ammonia within a county, where the objective is the minimization of both transportation and potential incident costs. Results for the minimization models will be compared to North Dakota's existing anhydrous ammonia distribution network to determine if the policies are indeed adequately safe. The specific objectives are:

- Use a mathematical programming minimal cost model for anhydrous ammonia transportation to determine the optimal number and location of licensed dealers within a county to minimize both transportation and potential incident costs,
- Compare results that include only private costs with results that include social costs of hazmat accidents,

- Compare stylized results with current locations of North Dakota licensed dealers, and
- Utilize results to assess hazmat transportation policies.

Thesis Organization

This thesis is organized into five chapters. Chapter II is a review of past studies associated with the transportation of hazardous material. This includes safety issues, regulatory polices, data sources, and existing models used in making transportation infrastructure decisions. Chapter III provides a description of the theory and methodology behind this study, as well as estimation procedures. Chapter IV reports the Results of the estimation procedures. Chapter V provides a summary, conclusions, and implications of the results, limitations of the study, and suggestions for future research.

CHAPTER II

LITERATURE REVIEW

This chapter reviews literature pertaining to the transportation of hazardous material. This review is separated into four sections:

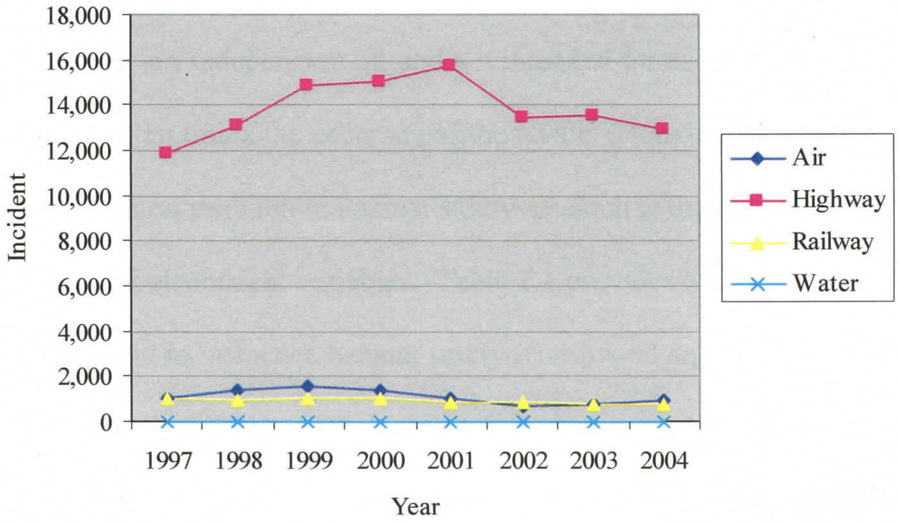
- A review of literature relevant to the safety issues associated with the transportation of hazardous material,
- A review of the regulatory policies associated with the transportation of anhydrous ammonia within North Dakota,
- An analysis of existing data-bases containing incident and accident data related to the transport of hazardous material, and
- A review of existing models used for managing the transportation of hazardous material.

A review of the regulatory policies both at the national and local levels linked with the transportation of hazardous material is included in Appendix A.

Safety Issues in Hazardous Material Transportation

Accidents and incidents in hazardous material transportation need to be carefully distinguished. Traffic accidents are occurrences to vehicles on public highways involving collisions between vehicles, collisions between vehicles and other objects, a vehicle running off the road, or a vehicle overturning on the road (Harwood and Russell, 1990). Traffic accidents involving vehicles transporting hazardous material do not necessarily result in a release of those materials. A hazardous material transportation incident, on the other hand, is any occurrence resulting in an uncontrolled release of material, during transport, which is capable of posing risk to health, safety, and property, as defined by the Department of Transportation Materials Transport regulations.

Figure 2.1 illustrates the frequency of hazardous material incidents by transportation mode for the period of 1997 - 2004, as determined by the Office of Hazardous Materials Safety. This figure shows that the vast majority of reported hazmat incidents involve highway transportation, as opposed to the air, rail, and water modes.



Source: Office of Hazardous Materials Safety (OHMS) (2004b).

Figure 2.1. Hazardous Incidents by Mode, 1997-2004.

Two fundamental objectives in the safe management of hazardous material transportation are (1) to minimize the risk of personal injury and property damage due to traffic accidents and (2) to minimize the risk of personal injury and property damage due to other causes (e.g., valve and container leaks) (Harwood and Russell, 1990).

The investigation of hazmat safety questions require both accident and exposure data. Accident data consists of reports of traffic accidents obtained either from police reports or from independent follow-up investigations. Each record in an accident data base documents the characteristics of a particular accident. Exposure data provides a measure of the probability of accidents to occur. Typical exposure measures in hazmat safety studies are vehicle-miles of truck travel or ton-miles of cargo shipped (Harwood and Russell, 1990).

A major weakness in most hazmat safety research is that exposure data that corresponds well to the available accident data is difficult to obtain due to the cost and difficulty of collecting. Researchers usually find it necessary to make exposure estimates from data sources that are independent of, and not intended for use with, the available accident data. This often limits the accuracy of the results (Harwood and Russell, 1990).

Another structural problem in hazmat safety research is the inability to consider the effects of all relevant independent variables. Table 2.1 provides a partial list of the broad range of factors thought to influence hazmat safety (Hardwood and Russell, 1990).

There are countless driver, vehicle, and roadway factors that influence hazmat accident rates. The primary factor is highway type, which has a critical impact on hazmat accident rates. Figures 2.2 and 2.3 provide data depicting the rural (Figure 2.2) and urban (Figure 2.3) fatal crashes by roadway function class (NHTSA, 2004).

Four design factors of the highway and its surrounding environment used to define highway types are as follows:

- Type of development (urban/rural),
- Access control (freeway/non-freeway),
- Number of lanes, and
- Presence or absence of median (divided/undivided).

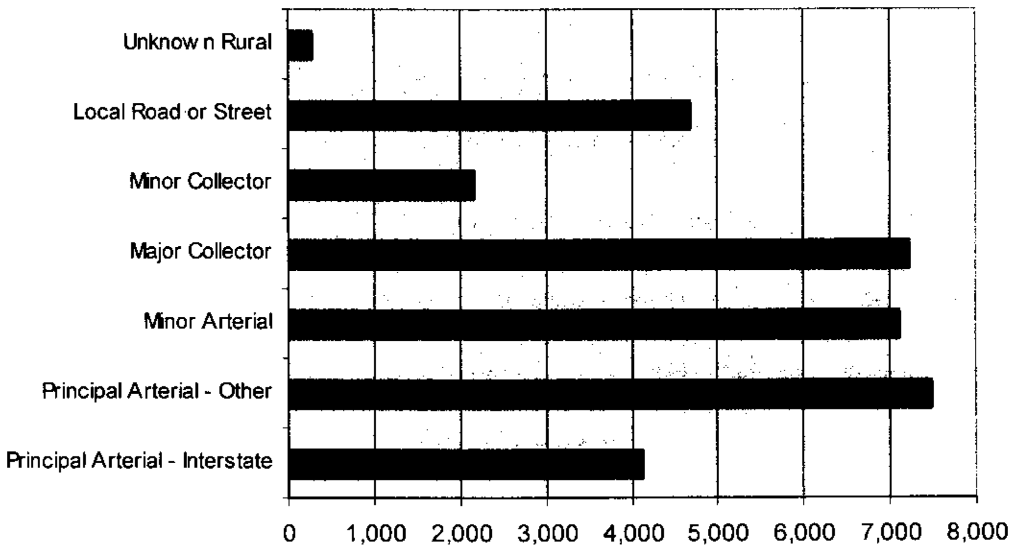
Table 2.1. Factors Considered to Affect Hazardous Material Accidents

TRUCK TYPE OR CONFIGURATION	HIGHWAY
Number of trailers	Function
Number of axles on tractor/trailer(s)	Access control
Cab type	Number of lanes
Cargo area configuration	Lane width
	Shoulder width
TRUCK SIZE AND WEIGHT	Median width
Width of trailer	Horizontal alignment
Length, overall	Vertical alignment
Length, trailer(s)	Surface condition (wet/dry/etc.)
Empty/loaded	Pavement condition
Weight, gross	Pavement type
Weight, trailer	
	TRAFFIC
TRUCK OPERATIONS	Volume (ADT)
Cargo type	Volume (day/night)
Operator type	Percent trucks
Trip type	
	ENVIRONMENT
TRUCK DRIVER	Visibility
Age	Weather
Experience with rig	Light
Hours of service	
Driver condition	TEMPORAL
	Month/season of year
LOCATION	Day of week
State	Time of day
Urban/rural	

Source: Harwood and Russell (1990).

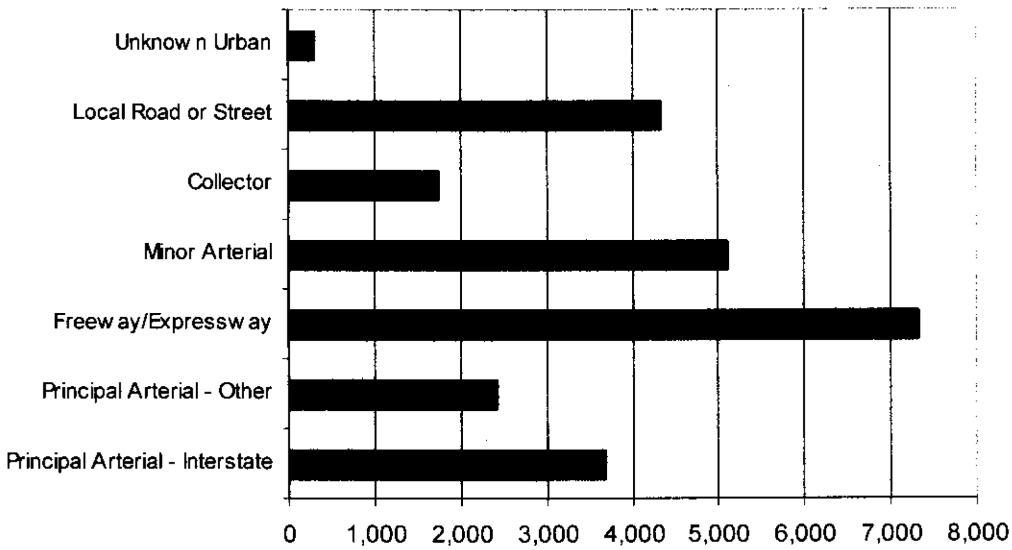
Highway type is a critical factor in comparing the risk of hazardous material releases due to traffic accidents between alternative routes.

There are two types of highway design issues in hazardous material transportation: (1) design features associated with hazmat accidents and (2) protective systems that can be designed into highways to mitigate the consequences of hazmat releases. Specific highway design features associated with hazmat accidents include horizontal curves, grades, crest vertical curves, passing zones, railroad grade crossings, interchange ramps, and shoulders. Horizontal curves are common sites for large truck accidents. A National Highway Traffic



Source: National Highway Traffic Safety Administration (2004).

Figure 2.2. Rural Fatal Crashes by Roadway Function Class, 2004.



Source: National Highway Traffic Safety Administration (2004).

Figure 2.3. Urban Fatal Crashes by Roadway Function Class, 2004.

Safety Administration (NHTSA, 2003) analysis of fatal large truck crashes found that the odds of a jackknife on a curved roadway are 86 percent higher than the odds of a jackknife on a straight roadway. Roadside design improvements to reduce the consequences of running off the road are important in reducing the consequences of such accidents.

Large trucks tend to have special safety problems on grades. On upgrades, they often travel slowly and are subject to being rear ended by overtaking vehicles. On downgrades, large trucks are susceptible to runaway accidents, overtaking, or rear ending slower vehicles. To alleviate safety problems of these types, highway agencies typically provide truck climbing lanes on upgrades and runaway truck escape ramps on downgrades.

An important aspect of highway design is to ease the consequences of hazmat releases. This can be achieved by providing operational flexibility that allows emergency response personnel and equipment to reach an accident site quickly, and that allows traffic to be rerouted away from an incident. Examples of designs with operational flexibility of this type are traversable medians, median crossover at regular intervals, and wide shoulders. On high-volume freeways, with frequent hazmat shipments, permanently installed response capabilities, such as fixed-site foam blanketing systems, could be considered.

The remainder of this section presents additional studies concerning safety issues of transporting hazardous material. Ando and Khanna (2004) evaluated Natural Resource Damage Assessment (NRDA) methods used to gage the level of damage in the case of hazardous material releases. The authors proposed that a set of unbiased, simplified NRDA methods are required to ensure that firms take efficient levels of precaution to avoid accidents (of all levels) that cause Natural Resource Damages (NRD). The authors proposed the following criteria for developing a low-cost NRDA method. The method must be simple to use, it must have legal recognition (by a state or federal legal establishment), it must be transparent, its damage estimates must vary with the scope of the accident, it must calculate net present value appropriately, it must have an unbiased estimate of public use and nonuse values, and it must reflect socioeconomic characteristics of the affected population. The authors advocated the government use of simple and low-cost NRDA methods. The authors' primary supportive point was that the use of these methods encourages firms to take efficient levels of precaution, as NRD cases will be pursued at nearly any level of hazardous release and not just the significant cases.

Goldsmith and Basak (1999) presented a principal-agent approach to address the issue of environmental risk sharing within a firm. The principal (top management), fearing penalties for environmental damages, wants to avoid environmental harm and induce the agent (employee manipulating hazardous material) to take appropriate actions to achieve due diligence. The difficulty from the principal perspective is his/her inability to observe perfectly the actions of the agent due to high monitoring costs and technical infeasibility. The principal must design an incentive program that will induce the agent to take the best action from the principal's perspective. The authors allowed the principal to use environmental performance indicators (EPI) to gauge the effort level of the agent. The authors concluded that either of two strategies must occur to more closely achieve the efficient principal: (1) an agent contract where risk is shared and (2) improve metrics and alternative risk-sharing mechanisms.

Dennis (1996) conducted a study calculating risk costs per unit of exposure for major hazardous material releases involving railroad transportation. Risk costs are the costs associated with the risk to human health, property, or the environment from the transportation of hazardous material. Risk costs are expressed as some number of dollars per unit of exposure such as ton-miles or carloads. The author used actual cost data from carriers for the period of 1982-1992 to estimate the risk costs per unit of exposure associated with railroad transportation of hazardous material. The author identified total safety adjusted risk costs of $348 million for the entire population of major releases over the eleven-year period.

Opaluch (1984) proposed the theory that strict liability for damages associated with pollution can potentially internalize pollution externalities, and thus can be viewed as a form of economic incentive for pollution control. Several difficulties with current regulations lead to less than complete financial responsibility for damages from pollution incidents. In addition, inappropriate expectations concerning the probability of accidents may lead to imperfect internalization, particularly in the case of low probability events. Overall, the author focused on the role that strict liability legislation can play as an incentive for possible polluters to take the necessary precautions to avoid potential releases of hazardous material.

Ensuring the safe transportation of hazardous material is a matter of growing concern among citizens, government regulators, shippers, and carries. The purpose of a study performed by Abkowitz (1991) was to explore the current environment in which hazardous material transportation safety is being addressed, progress made to date in the safety of such transport, and the potential for future improvements. There are several distinct interest groups that have a stake in the reduction of hazardous material transport risk, including the public, government, and industry. The author specified that the essential ingredient to future success is the delicate partnership between the federal government, state and local governments, and industry, in addressing hazardous material transportation safety. The author concluded that without a commitment from all parties, additional improvements will not occur associated with risk prevention and hazardous material transportation.

Brown et al. (2001) conducted a quantitative risk assessment to estimate the risk on a national basis of the transportation of (a) the six toxic-by-inhalation (TIH) chemicals that account for over 90% of total TIH transportation-related risk, (b) liquefied petroleum gas, (c) gasoline, and (d) explosives. The six TIH materials evaluated were ammonia, chlorine, sulfur dioxide, fuming sulfuric acid, fuming nitric acid, and hydrogen fluoride. The objective of their study was to characterize the relative risks of transporting the selected hazardous material by evaluating health and safety effects to the public and to workers from accidental releases, and to evaluate the probability of certain consequences occurring over a given time period. The study employed Monte-Carlo sampling of input variables to calculate long-term risks. The statistical distributions included temporal incident rates, discharge fractions, population density, and meteorological conditions. The researchers employed the Chemical Accident Stochastic Risk Assessment Model (CASRAM) to estimate the statistical distribution of potential injuries and fatalities for each representative shipment developed in the commodity flow and shipment analysis. For highways, the authors adopted state data of Harwood and Russell as the basis for their accident probabilities. The quantitative results from the research included cumulative probability distributions for injuries and fatalities for a 10-year period. It was also determined that the total risk and injuries resulting from gasoline transportation exceeds that of LP gas, TIH materials, and explosives by a large margin. Liquefied flammable gases pose a much greater risk than flammable liquids on a per shipment basis, even though the containers used for the transportation of flammable liquids are substantially less robust. Total transportation-related injury risk for TIH material is considerably greater than that for LP gas, gasoline, and explosives.

Transportation of Anhydrous Ammonia Within North Dakota

A farmer, rancher, dealer, or commercial fertilizer company employee may pull no more than two portable empty tanks and one full tank behind a farm tractor, pickup, or truck. The speed limit may not exceed 25 miles per hour, empty or full. The overall length of the entire transporting unit may not exceed 75 feet. Nurse tanks can be transported on public roads between sunrise and sunset only. A slow moving vehicle (SMV) emblem must be displayed on the rear. A lighted rotating or flashing amber light may be displayed in lieu of the SMV emblem. Safety chains must be used if anhydrous nurse tanks are towed faster than 15 miles per hour. Tanks must be identified on the front, rear, and both sides with the words "ANHYDOUS AMMONIA" in letters not less than 2 inches high. Tanks must be placarded on the front, rear, and on both sides with approved DOT "NON-FLAMMABLE GAS" placards. A non-flammable gas placard with the numbers 1005 (identifying it as anhydrous ammonia) must be located on both sides and both ends of the tank. The operator of a vehicle towing anhydrous ammonia equipment (applicator and nurse tanks) on the road is fully responsible for its safe transport (Maher, 1998).

Data Sources for Incident-Accident Information

The data for analyzing hazardous material incidents emanate from the reports filed by carriers and others responsible for reporting to various agencies under federal regulations. Given that this study focuses on the transportation of anhydrous ammonia by roadway, only databases containing roadway incident-accident information will be discussed.

Any unintentional release of hazardous material during transportation, loading or unloading, or temporary storage throughout the transportation infrastructure must be reported to the Office of Hazardous Materials Transport (OHMT) as a Hazardous Materials Incident Report (HMIR), with the exception of consumer commodities that present only a limited hazard during transport. An additional telephone-reporting requirement is imposed on carriers when an incident meets certain criteria. One shortcoming of the OHMT HMIR is that it does not receive reports on all incidents because the HMIR relies on voluntary reporting from carriers. Companies involved only in the loading, unloading, or storage of hazardous material are not required to submit hazardous material incident reports. The DOT has elected not to regulate firms involved only in intrastate transportation or to require them to submit hazardous material incidents reports. The OHMT has no systematic procedure for refining reported data that are incomplete or inaccurate. This results in an understatement of the overall impact of hazardous material transportation incidents. Despite the criticisms of the HMIR database, in many respects, it serves as the most relevant database for conducting hazardous material transport incident and safety analysis, as the HMIR database is the only one exclusively devoted to hazardous material transportation incidents (Abkowitz and List, 1987).

The Federal Highway Administration (FHWA) Bureau of Motor Carrier Safety (BMCS) maintains a database on accidents. It includes any motor carrier accident in which a fatality or injury occurred, or for which there was at least $2,000 in property damage. The BMCS database includes carrier identification and address, location of the incident, characteristics of the event, cause, information on the cargo, and consequences of the accident (Harwood and Russell, 1990).

The National Highway Traffic Safety Administration (NHTSA) National Center for Statistics and Analysis maintains accident data on police-reported accidents, including those that resulted in nonfatal injury, or property damage, or both. The file of reported accidents, called the National Accident Sampling System (NASS), was developed to provide an automated, comprehensive national traffic accident database. The data collection for a NASS selected accident includes characteristics of the accident, driver, occupants, and vehicle. Although the specific commodity being carried is not described, sufficient information exists to track accidents that are likely to have contained hazardous material cargo. Those accidents that result in loss of human life are classified separately in the Fatal Accident Reporting System (FARS) (Harwood and Russell, 1990).

The information provided by telephone reports to the National Response Center (NRC) can be used for hazmat policy analysis. Data items include the location of the incident, mode of transportation involved, material involved, and quantity released (Harwood and Russell, 1990).

The Environmental Protection Agency (EPA) regional offices have personnel to receive notifications of releases of hazardous substances. These notifications are integrated into a regional incident-reporting system. Typical reports include the incident data, company involved, spill location, nature of the emergency, material spilled and volume, source of the spill, responding agency, nature of the response, and resolution (Harwood and Russell, 1990).

The National Transportation Safety Board (NTSB) receives the NRC telephone reports, which are used to determine whether to proceed with an investigation. An NTSB investigation begins with a multiple-day field investigation involving the shipper, carrier, government agencies, associations, and other interested parties. A report is subsequently generated that goes through several cycles of review and comment before it is finalized. Some advantages of the NTSB process are that the investigations involve other participants, besides the carrier; they are extremely thorough; and the investigations take place over a longer time frame. Thereby, the full impact of the accident can be more accurately identified. NTSB does maintain a database on the vital statistics of each investigated accident (Harwood and Russell, 1990).

Accident-incident databases maintained by state and local agencies vary considerably, depending on the authorities involved and the level of commitment that has been made to manage the hazardous material transportation problem. State and local agencies appear to be more directly involved in the accident-reporting systems than in incident-reporting systems, and focus much of their attention on the highway mode (Harwood and Russell, 1990).

A number of suggestions have been made to improve the accuracy and completeness of hazardous material incident reporting. These recommendations focus on the contents of the incident report form, criteria and procedures for incident notification, and internal management of reported information. As long as hazardous material are transported, methods of incident-accident information collection will be necessary for proper management of hazardous material transportation (Harwood and Russell, 1990).

Review of Existing Models for Hazardous Material Management

Many researchers have attempted to determine the type, location, size of treatment and disposal facilities, and the transportation routes throughout a hazardous material transportation infrastructure. Some of the pertinent studies are discussed below.

Erkut and Ingolfsson (2004) presented three different catastrophe-avoidance models for routing decisions associated with hazardous material transportation. In the first model, catastrophe avoidance is achieved by minimizing the maximum population exposed. In the second model, the variance of the route consequence is incorporated into the decision. And, in the final model, an explicit disutility function is used. The authors presented three different route selection models to assist decision makers to determine their optimal route, given their preferences.

Beroggi and Wallace (1995) studied the re-routing of hazardous material vehicles due to an unforeseeable event. Alternative routes for vehicles on a transportation network must be evaluated whenever an unexpected event occurs that could affect the safety or efficiency of a shipment. Two of the models presented by the authors, supported the dispatcher in making decisions by proposing alternative routes. The other two models supported the dispatcher in making decisions based on the attributes of risk and cost. The four decision models are Visual Interactive (VI) model – only the planned routes of the vehicles are shown on the map on the screen as an explicit alternative, Conservative Heuristic (CH) model – two alternatives are shown on the map on the screen (the planned route and the worst-case solution), Ordinal Preference (OP) model – the two attributes used for routing shipments are risks and costs, and Multi-attribute Utility (MAU) model – which uses numerical values for both risk and transportation costs. The authors concluded that decision making by attributes can be quite superior to decision making by alternative.

Douligeris et al. (1999) addressed the strategic level routing problem of hazardous material in marine waters over a multi-commodity network with multiple origin-destinations. The focus of the study was motivated by the fact that selecting optimal routes by each origin-destination pair, or by each type of material, may result in overloading certain routes of transportation, which lead to overall poor system performance. The objective of the study was to generate best global strategies to balance the tradeoffs between the transport costs and the expected total risk costs, while enforcing an equitable distribution of risk.

The problem of determining optimal paths for routing an undesirable vehicle was studied by Batta and Chiu (1988). The objective of their study was to minimize the expected damages where an accidental leakage of hazardous material could inflict damage within a neighborhood of the accident site. The authors made a few observations from their study. These included paths with fewer nodes are preferred, because accident probabilities at nodes are relatively high compared to accident probabilities on links, paths with low accident probabilities per unit length are preferred, and paths that have shorter travel times are preferred.

An additional routing problem was addressed by Batta et al. (1990). The objective of their study was to determine a set of routes for hazardous material shipments that would minimize the total risk of travel and spread the risk equitably among the zones of the geographical region in which the transportation network is embedded, when several trips are necessary from origin to destination. The authors presented an integer programming formulation to address this problem. Findings from their study indicated that one can achieve a high degree of equity by modestly increasing the total risk and by embarking on different routes to evenly spread the risk among the zones.

Hu et al. (2002) postulated that hazardous-waste reverse logistics may be useful for solving waste-induced environmental pollution problems that accompany high-technology industrial development. The authors defined a reverse logistic system as the process of planning, managing, and controlling the flow of waste for either reuse or final disposal. The traditional measures used for the treatment of hazardous waste (i.e., waste processing technologies) have been inadequate for integrating waste management, collection, storage, distribution, and transportation activities into comprehensive, reverse logistics operating strategies. The problem addressed by this study was to formulate a hazardous-waste reverse logistics cost model, using a multi-time-step, multi-type operations process that minimizes the logistics costs subject to constraints that take into account business operating strategies and governmental regulations. The authors made several assumptions, such as network configurations are given including geographical characteristics and capacity, the costs of internal distribution are ignored, and demands for hazardous waste treatment are known. The objective function included total collection costs, total storage costs, total treatment costs, total transportation costs for reusing the waste, and total transportation costs for disposing of the waste. The constraints of the model included a minimum hazardous waste collection and treatment amount (government regulations/business operations), limits on hazardous waste collection and treatment given demand and capacity, storage capacity with safety considerations, and non-negativity constraints. Their model produced a few generalizations. Looser requirements of the minimal collection and treatment amounts helped to improve the performance of the model. Both the public and private sectors must identify the relationship between the marginal cost and benefit of a hazardous-waste reverse logistics system before making any system operations decisions. Using the proposed model, the government can evaluate alternatives to deregulation policies with respect to the minimal waste collection amount committed to the hazardous-waste treatment enterprises. The private sector can use the proposed model to adjust their waste collection strategies in response to any related government requirements. Overall, the study focused on helping private sector businesses, and the government, to evaluate the effects of various collection and treatment constraints on reverse logistic costs.

Kara and Verter (2004) presented an analytical approach for addressing the problems of designing a road network for the transportation of hazardous material. The researchers took the viewpoint of both the regulator (government) and the carrier. The primary measure utilized by regulators, in order to reduce the transport risk in their jurisdiction, is to close certain road segments to hazardous material transportation. This leads to the dilemma from the regulators perspective of selecting the road segments that should be closed to hazardous material transport, so as to minimize the total risk. As the government agency is in a leader position, since the carriers have to follow the regulations, the authors proposed a bi-level framework to represent the problem. The objectives of the model were, population exposure and travel distance. The objective function values determined the minimum population exposure attainable, by banning certain road segments to hazmat trucks. Their findings indicated that both parties are better off when minimum exposure routes are used for all shipments. Their model can be used for identifying road segments that should be closed to hazardous material shipments, evaluating alternative regulatory schemes, and for identifying the risk and cost impact of adding new links to an existing road network. Overall, the authors set up a model to determine the optimal regulatory strategy for a regulator i.e. what roadways should be closed from hazmat transport, given the population exposure and the knowledge that carriers will choose the least cost transportation route.

A case study in developing policy options for regulating hazardous material truck routes was presented by Turnquist and List (1991). Multiple objectives were incorporated in the researchers' analysis and decision making including population density, type of highway, types and quantities of hazardous material, emergency response capabilities, exposure and other risk factors, and delays in transportation. The database for the analysis contained several different measures including length, travel time, estimated truck operating cost based on length and travel time, estimated accident rate per truck trip, estimated population residing within one-half mile on either side of the link based on 1990 census data, and number of schools within one-half mile on either side of the link. Truck operating cost estimates were based on earlier work by Abkowitz et al. (1984) and rates of estimated accidents (per truck trip) were based on hazardous material release accident rates for various roadway classes, as cited by Harwood and Russell (1990). The authors used multi-objective routing analysis software to find all non-dominated routes, using a set of criteria including operating cost, accident rate, population exposure, and number of schools in exposure area. The authors concluded that micromanagement of routing choice by the trucking industry may not be necessary, and route designation may not be required. Pruning a few links from the network where hazardous material truck traffic is undesirable may well be sufficient. Also, the authors determined that a real-world, multi-objective, routing analysis can be conducted and that it can yield useful results. Trade-offs can be examined in risk-related measures (population and the number of schools exposed), and their relationship to incident (accident) likelihoods. Overall, the authors concluded that a comprehensive methodology is emerging to deal with the complex, multi-objective, task of making high quality decisions for the safe shipment of both hazardous material and wastes.

List (1991) presented a model capable of recommending sites for hazardous material emergency response teams, where the primary concern was over transportation-related incidents, when multiple objectives were involved. Sites are chosen so that certain objectives are minimized, including the average and maximum response time, and the average and maximum levels of risk imposed. This is accomplished through the characteristics of the sites available, the hazmat flow patterns, the accident and incident probabilities for the network, and the region's population distribution. Notification, mobilization, transit, and containment time were included in the model. The probability of injury is captured by combining the probability-of-injury model presented by Abkowitz and Cheng (1990), with the segment-to-zone impact assessment methodology described by List and Mirchandani (1990). The authors concluded that it is possible to incorporate response time into the analysis framework, and that its value can be significant. The difference in siting patterns between minimizing risk and minimizing response time are significant, especially when the number of sites is small. Overall, a real world multi-objective siting analysis has shown that the model can be used to yield useful results. The authors concluded that the multi-objective approach to the problem provides helpful insights into proper selection of sites, particularly when a limited number must be chosen.

A utility function approach to integrate both cost and risk related objectives in the planning and design of a regional hazardous waste management system (RHWMS) was presented by Nema and Gupta (1999). The design of a RHWMS involved the selection of treatment and disposal facilities, allocation of hazardous wastes and waste residues from generator to the treatment and disposal sites, and selection of the transportation routes. The objectives of this paper were to review existing optimization models for hazardous waste management and present a mathematical model, which can be used as a tool to select hazardous waste treatment and disposal facilities and transportation routes. The authors presented a model that addresses the diverse characteristics of different wastes; compatibility between different waste types; waste residue generated from waste treatment facilities; formulation of the siting problem using 0-1 decision variables; and consideration of multiple objectives including risk, cost, and/or joint functions of risk and cost. The authors concluded that by recognizing and incorporating these issues a more effective management model can be achieved. The results can be summarized as follows: total cost and total risk of the system have inverse relationships; solution for minimum cost and minimum risk may differ in technologies associated with the sites, allocation of the wastes to the technologies, routing of the hazardous wastes and residues, and the choice of the landfill sites; and ideally waste treatment facilities and disposal facilities should be at the same site unless demanded by site specific constraints. The model can improve decision making by minimizing risks for a given budget; reflecting issues related to total risks, siting risk and transportation risks; and setting up a management model, given limited information on risks and cost.

CHAPTER III

METHODOLOGY AND DATA

This chapter describes the methodology and data used to determine the optimal configuration of licensed dealers of anhydrous ammonia within a county, in order to minimize the overall social cost of its transport. Three stylized counties were created, that represent the attributes of the eastern, western, and central counties of North Dakota. The eastern counties include those in the north east (NE), east central (EC), and south east (SE) crop reporting districts (CRDs). The western counties include those in the north west (NW), west central (WC), and south west (SW) CRD. The central counties include those in the north central (NC), central (CENT), and south central (SC) CRD (Figure 3.1). Transportation costs and incident costs were calculated from research performed in related studies. Mathematical programming techniques were used to determine the optimal configuration of licensed dealers within these counties, in order to minimize the summation of the private and social costs of transport. The following sections describe the background, model formulation, and data sources.

Background Information

This study determines the optimal configuration of licensed dealers of anhydrous ammonia within a county, in order to minimize the overall social cost of transportation subject to constraints. The regional network for the distribution of anhydrous ammonia in North Dakota consists of a number of licensed dealers. From the dealer, anhydrous ammonia can either be distributed directly to the farmer, or the farmer can travel to the licensed dealer and transport the product to the farm. The transportation of anhydrous ammonia involves costs, and poses some risk to the environment. Thus, the problem is to

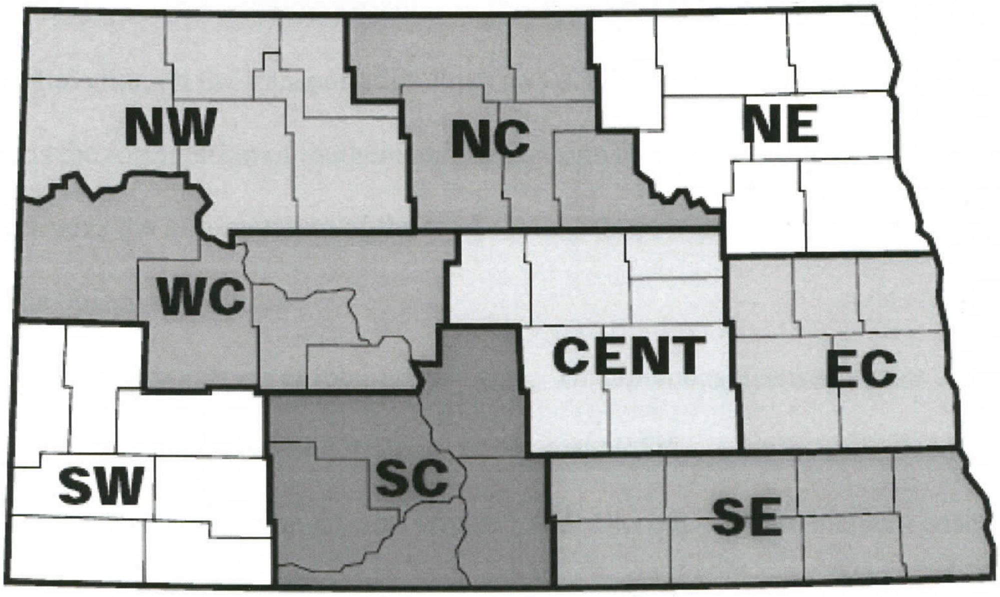


Figure 3.1. North Dakota Crop Reporting Districts.

select an optimal configuration of licensed anhydrous ammonia dealers, so that anhydrous ammonia is managed with minimum cost and minimum risk to the transporter, surrounding communities, and the environment. This optimal solution will then be compared to an alternative solution, resulting from the minimization of private costs.

Model Formulation

In order to facilitate the development of the optimization model, the representative counties were divided into nodes. Nodes may be the entrance for manufacturers supplying anhydrous ammonia, the site of the licensed dealers distributing anhydrous ammonia, or the site of the potential farms applying anhydrous ammonia. Each county consists of 91 nodes, representing 1,456 square miles. Nodes are connected to each other by means of transportation routes. The manufacturers must transport the anhydrous ammonia to the appropriate licensed dealer. The available anhydrous ammonia is then transported to the appropriate farm for application. The model formulation starts with the identification of decision variables. The decision variables in this case are (1) anhydrous ammonia quantities traveling on the transportation links and (2) the location of licensed dealers. The final step is the formulation of mathematical equations for the objective and constraints. The objective is the minimization of the total social cost of transportation.

The objective includes

- Minimization of total private cost. This includes licensed dealer costs (fixed and variable costs), transportation costs (of the manufacturer, licensed dealer, and farmer), and private incident costs. Private incident costs includes the internal costs of transportation risk (of the manufacturer, licensed dealer, and farmer) and consequences of a release of anhydrous ammoniam; and
- Minimization of total social cost. This includes all of the private costs to dealers and farmers, and the expected incident costs that are not internal to the dealers and farmers.

The problem is subject to the following constraints:

- Each node will receive sufficient anhydrous ammonia to meet the fertilizer requirements of the crops grown in that node, and
- The total amount of anhydrous ammonia produced and transported is restricted by technology and regulation.

The assumptions are:

- The counties are divided into manufacturer entrance nodes, licensed dealer nodes, farm nodes, and transportation links;

- The population impacted by an anhydrous ammonia related incident is considered as an attribute of the transportation link;
- The transportation costs are directly proportional to the network distance used, with the constant of proportionality being independent of the value of the distance;
- The risk functions for anhydrous ammonia transportation are directly proportional to the quantity of anhydrous ammonia being transported, the road type being used, and the distance traveled; and
- All anhydrous ammonia transportation, from the dealer to the farm, is done by the farmer.

Estimation of Expected Cost of Incident

The objective function is the minimization of the sum of anhydrous ammonia storage, distribution, and transportation costs, as well as expected incident cost. Incident cost is composed of a risk estimation, which involves the identification of factors leading to an undesirable event (i.e. a spill), its probability, and the assessment of the probable outcomes of the undesirable event. It also involves the quantification of the consequences of the event. An undesirable event in this context is the release of anhydrous ammonia due to an accident during transport. The probability of occurrence of an accident within a specified period can be estimated based on either historical data or adapting the results from previous studies to the current circumstances. The consequences of the accident can be estimated based on the physical and chemical properties of anhydrous ammonia, its quantity, and the sensitivity of the exposed environment to the accidental release.

The total cost of anhydrous ammonia storage and distribution is assumed to consist of a fixed cost for installing the facility, and a variable operational cost, depending upon the quantity of the anhydrous ammonia being distributed through the licensed dealer. Transportation cost is the function of the anhydrous ammonia quantity being transported, distance between the nodes, and the unit cost of transportation. Total cost of the anhydrous ammonia management system includes cost of anhydrous ammonia transportation, as well as storage and distribution technology costs.

Formulation of the Objective Function

The objective function of the mathematical programming model is the minimization of the total cost of anhydrous ammonia distribution.

Assume there are L transportation links $l \varepsilon L$,

M transportation methods $m \varepsilon M$,

K alternative sites $k \varepsilon K$,

T technologies $t \varepsilon T$, and

Nodes indexed r and s.

The objective function is

(1) MIN $\sum \sum \; TOTC + IC$

with

(2) $TOTC = \{TDC + TRC\}$

(3) $TDC = FC + VC$

(4) $FC = \sum k \varepsilon K \sum t \varepsilon T \{FC_{tk} \times y_{tk}\}$

(4) $VC = \sum k \varepsilon K \sum t \varepsilon T \{ASD_{tk} \times VC_{tk}\}$

(5) $TRC = \sum l\varepsilon L \sum m\varepsilon M\{A_{mrs} \times D_{rs} \times TC_m\}$

(6) $IC = \sum l\varepsilon L \sum m\varepsilon M\{PR_{mrs} * EC_{mrs}\}$

where

$TOTC$ = total cost of the anhydrous ammonia management system;

TDC = licensed dealer capital and operations costs;

TRC = transportation costs;

FC = fixed cost of the licensed dealers' storage and distribution technology;

FC_{tk} = capital or fixed cost of the technology, t, at the site;

y_{tk} = 0 – 1 variable which represents the presence or absence of the storage and distribution technology, t, at the site, k;

VC = variable cost of storage and distribution;

ASD_{tk} = anhydrous ammonia quantity, to be stored and distributed at site, k, using technology, t;

VC_{tk} = unit storage and distribution cost for anhydrous ammonia using technology, t, at site, k;

A_{mrs} = anhydrous ammonia quantity traveling between nodes, r, and, s, with transportation method, m;

D_{rs} = length of the link, l, joining nodes, r, and, s, (r and s represents any pair of nodes);

TC_m = unit transportation cost for the transportation method, m;

IC = incident cost;

PR_{mrs} = probability of an accident on link, l, with transportation method, m, joining nodes, r, and, s; and

EC_{mrs} = the estimated consequence of a release of anhydrous ammonia on link, l, with transportation method, m, joining nodes, r, and, s.

Formulation of the Constraints

The mass balance between anhydrous ammonia entering the system and the licensed dealers' storage and distribution quantities is formulated in Eq. (7). The equation states that all the anhydrous ammonia entering the system must be transported to a licensed dealer.

(7) $\sum k\varepsilon K \sum m\varepsilon M \{A_{mik} - A_{mki}\} = Q_i$ (for all i),

where

i = manufacturer entrance node;

k = licensed dealer node;

A_{mik} = quantity of anhydrous ammonia traveling between the nodes, i, and, k, with transportation method, m; and

Q_i = quantity of anhydrous ammonia entering the network at node, i.

At the licensed dealer nodes, the anhydrous ammonia quantities arriving must be balanced with the anhydrous ammonia quantities being transported away from the licensed dealer [Eq. (8)].

(8) $\sum i\varepsilon I \sum m\varepsilon M \{A_{mki} - A_{mik}\} + \sum j\varepsilon J \sum m\varepsilon M \{A_{mkj} - A_{mjk}\} = 0$ (for all k),

where

j = farm node.

The anhydrous ammonia quantities being transported to a licensed dealer should not exceed the capacity of the licensed dealer's storage and distribution facility [Eq. (9)].

(9) $ATD_{tk} \leq C_{tk}$ (for all k and t),

where

ATD_{tk} = anhydrous ammonia quantity stored and distributed with technology, t, at node, k; and

C_{tk} = Capacity of technology, t, at node, k.

The anhydrous ammonia quantity being transported to a farm node should meet or exceed the quantity demanded at that node [Eq. (10)].

(10) $\sum m\varepsilon M\{A_{mkj}\} \geq D_j$ (for all j),

where

D_j = the quantity demanded of anhydrous ammonia at node, j.

Farms must be within a certain road distance from at least one licensed dealer, based on North Dakota anhydrous ammonia transportation policy and the farms crop composition [Eq. (11)].

(11) $MI_{kj} \leq RD_{kj}$ (for all k and j),

where

MI_{kj} = the number of road miles from a licensed dealer at node, k, to a farm at node, j; and

RD_{kj} = a specified number of road miles that a farm at node, j, must be within at least one licensed dealer at node, k.

Data and Estimation Procedures

Three counties, which represent the attributes of eastern, central, and western North Dakota, were developed for analysis. Attributes of the counties include square mileage, population distribution, and crop composition. Each county is 1,456 square miles (Figure 3.2). This was determined by calculating the average square miles of a North Dakota county.

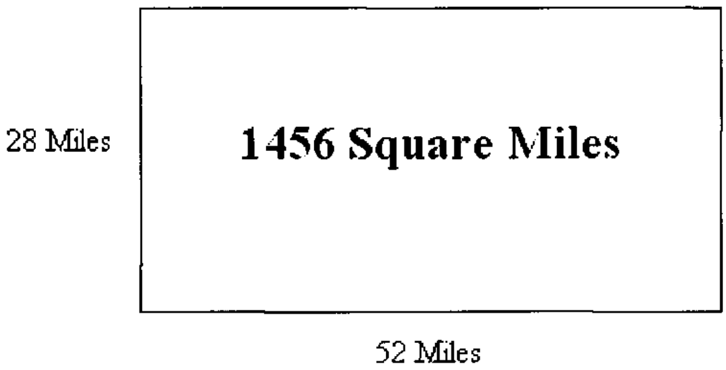


Figure 3.2. County Size.

Population for each county was also collected from the U.S. Census Bureau. The population distribution of each county is broken up into urban and rural nodes. The U.S. Census Bureau defines rural by exclusion and classifies 'urban' as all territory, population, and housing units, located within an urbanized area or an urban cluster. The square miles or number of urban nodes within each county was determined by taking the average land area of each county seat (U.S. Census Bureau, 2004) and urbanized area, throughout each crop reporting district, and rounding that to represent a number of nodes. This resulted in one urban node within each respective county.

Farm and cropland composition information was collected from the United States Department of Agriculture, National Agricultural Statistics Service. The average number of acres of barley, durum wheat, spring wheat, and corn, proportionally distributed within each region, was used as the acreage for each constructed county. This crop composition was selected because anhydrous ammonia is frequently applied to these crops (NDAS, 2005). Recommend nitrogen application rates were taken from the 2004 North Dakota Agricultural Statistics Annual Book (NDAS, 2005). There are a variety of sources of nitrogen, and statistics on the amount applied in the form of anhydrous ammonia were not readily available. It was assumed, based upon comments from agricultural extension specialists (Frazen, 2006), that fifty percent of total nitrogen application is in the form of anhydrous ammonia. Utilizing this information, the quantity demanded of anhydrous ammonia per county was calculated.

Each county consists of 91 nodes, out of which four nodes are entrances for manufacturers, 91 nodes represent potential licensed dealer locations, and 91 nodes contain acres of farm land. The four manufacturers' entrance nodes represent the square grid of North Dakota highways. Each network consists of 364 potential links between the manufacturer entrances and potential licensed dealer locations. There are 8,190 potential links between potential nodes of licensed dealers and nodes containing farm land. The node composition for each county is displayed in Figure 3.3. The attributes of each county are displayed in Tables 3.1, 3.2, and 3.3. Each county is assumed to have one urban node where population is representative of the urban areas within that region. The acres of cropland within the urban node are one fourth the size of the cropland in the rural nodes within that respective county.

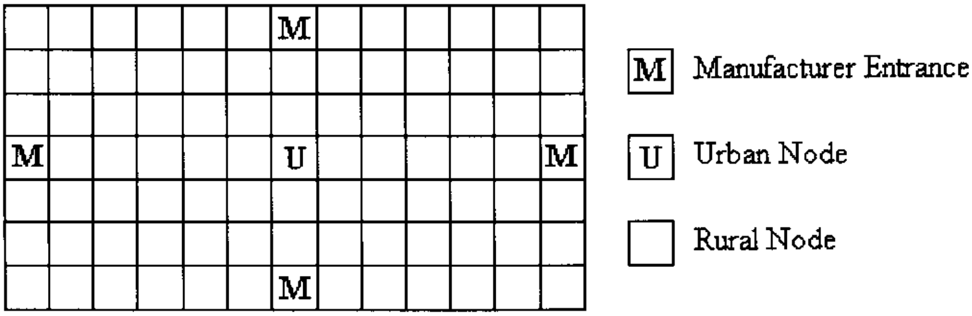


Figure 3.3. County Node Composition.

Table 3.1. Attributes of the Western County

	Total	Per Urban Node	Per Rural Node
Demographics			
Population	8,703	4,383	48
Cropland (acres)	115,069	319	1,275
Crop Composition			
Barley (acres)	15,433	43	171
Corn (acres)	3,971	11	44
Wheat Durum (acres)	43,049	119	477
Wheat Spring (acres)	52,616	146	583
Quantity Demanded			
Anhydrous Ammonia (gallons)	1,414,672	3,922	15,675

Table 3.2. Attributes of the Central County

	Total	Per Urban Node	Per Rural Node
Demographics			
Population	12,231	6,471	64
Cropland (acres)	94,402	262	1,046
Crop Composition			
Barley (acres)	20,126	56	223
Corn (acres)	14,169	39	157
Wheat Durum (acres)	4,152	12	46
Wheat Spring (acres)	55,955	155	620
Quantity Demanded			
Anhydrous Ammonia (gallons)	1,291,300	3,580	14,308

Table 3.3. Attributes of the Eastern County

	Total	Per Urban Node	Per Rural Node
Demographics			
Population	16,887	9,687	80
Cropland (acres)	113,083	313	1,253
Crop Composition			
Barley (acres)	10,469	29	116
Corn (acres)	34,746	96	385
Wheat Durum (acres)	1,715	5	19
Wheat Spring (acres)	66,153	183	733
Quantity Demanded			
Anhydrous Ammonia (gallons)	1,664,475	4,605	18,443

The risk formulation presented by Abkowitz and Cheng (1988) is the basis for the calculation of the incident cost, given a release of anhydrous ammonia during transport. The risk formulation model has been adjusted for this study [Eq. (12)].

(12) $B_{rs}^{j} = P_{rs}^{j}[D * C_D + I * C_I + CP + P_I(V)A^{j}(POP)^{j} C_I]$,

where

B_{rs}^{j} = the incident cost of transporting anhydrous ammonia from, r, to, s, on route, j;

P_{rs}^{j} = probability of a hazardous material accident from, r, to, s, on route segment, j;

D = average fatalities to individuals directly involved in an incident with anhydrous ammonia;

C_D = average cost of fatalities in dollars;

I = average injuries to individuals directly involved in an incident with anhydrous ammonia;

C_I = average cost of injuries in dollars;

CP = average damage to property from a release of anhydrous ammonia in dollars;

$P_I(V)$ = probability of injury to people in the vicinity of the incident location for a release of anhydrous ammonia given, V;

V = shipment size;

A^j = impact area (square miles) on link, j; and

$(POP)^j$ = population density (per square mile) associated with link, j.

To calculate the probability of a hazmat accident (P_{rs}^j) the Federal Highway Risk Assessment Model (FHWA), presented by Harwood and Russell (1990), was utilized [Eq. (13)].

(13) $P_{rs}^j = AR_{rs}^j \times L_{rs}^j \times FHZ$,

where

P_{rs}^j = probability of a hazardous material accident from, r, to, s, on route segment, j;

AR_{rs}^j = accident rate per vehicle-mile for all vehicle types from, r, to, s, on route segment, j;

L_{rs}^j = length (mi) from, r, to, s, on route segment, j; and

FHZ = fraction of all accidents that involve a hazmat release.

The accident rate per vehicle-mile was calculated by dividing the total number of accidents that occurred on each functional class of North Dakota roadway (NDDOT, 2001-2004), for the period of 2001-2004, by the total number of vehicle miles traveled on each roadway type for that same period (FHA, 2001-2004). The results for each roadway type are displayed in Table 3.4. The fraction of all accidents that involve a hazmat release was calculated by dividing the total number of hazmat incidents that occurred in North Dakota by roadway transportation for the period of 2001-2004 (OHMS, 2001-2004) by the total number of crashes that occurred in North Dakota over that same time period. The results are displayed in Table 3.4.

Table 3.4. North Dakota Accident Rates and Release Probability by Roadway Type

Roadway Type	Accident Rate Per Mil Veh-Mi (Accident Rate Million Veh-Mi)	Fraction of Accidents Involving Hazmat
Interstate	0.79	0.0014
Principal Arterial	2.62	0.0014
Minor Arterial	3.43	0.0014
Collectors	2.23	0.0014
Local	2.03	0.0014

Source: NDDOT (2001, 2002, 2003, 2004) and OHMS (2001, 2002, 2003, 2004).

The average fatalities to individuals directly involved in an incident with anhydrous ammonia (D) was calculated by summing the total number of fatalities, associated with anhydrous ammonia for the period of 2000-2004, divided by the total number of incidents for that same period, obtained from the Hazardous Material Incident Reporting (HMIR) database, maintained by the U.S. DOT, Research and Special Programs Administration. The average economic cost per fatality of North Dakota traffic crashes (NDVCF, 2001) was utilized for the variable of average cost of fatalities in dollars (C_d). Average injuries involved in an incident with anhydrous ammonia (I) was calculated by summing the total number of injuries associated with anhydrous ammonia, divided by the total number of incidents for the period of 2000-2004 (HMIR, 2001-2004). Damages awarded to individuals who were injured from a 2002 release of anhydrous ammonia in Minot, North

Dakota (Karnowski, 2006) were used to calculate the variable of average cost of injury in dollars (C_I). The average damage to property from a release of anhydrous ammonia in dollars (CP) was calculated by summing the total dollars of property damage, associated with anhydrous ammonia incidents, divided by the total number of incidents for the years of 2000-2004 (HMIR, 2001-2004). The values for these variables are presented in Table 3.5.

Table 3.5. Fatality, Injury, and Property Damage Values

Variable	Value
Average fatalities per anhydrous ammonia incident (D)	0.0152
Average cost of fatalities in dollars (C_d)	\$1,160,000
Average injuries per anhydrous ammonia incident (I)	0.2290
Average cost of injury in dollars (C_I)	\$938,482
Average damage to property per anhydrous ammonia incident (CP)	\$5,703

Source: Abkowitz and Cheng (1988).

The probability of injury to people in the vicinity of an incident location $[P_I(V)]$ is a function of the shipment size (V) and population density. The shipment size is contingent on the transportation technology being utilized. Manufacturer transportation tanks can range in sizes from 14.6 – 63.5 tons. In most cases MC330 or MC331 cargo tanks are utilized for anhydrous ammonia transportation, and on average 30 tons are transported at a time with these cargo tanks (HMIR, 2001-2004). Nurse tanks are operated when anhydrous ammonia is transported from a licensed dealer to a farm. The capacity of the tanks range from 1,000 to 2,000 gallons, but in most cases 1,500 gallon nurse tanks are employed (Weber, 2006). Cargo and nurse tanks can only haul 85% of the tank's capacity, given pressure constraints. Given the pressure constraints, the capacity for the manufacturer is 6,986 gallons and 1,275 gallons for farmers. These values were employed for the shipment size (V). The technique presented by Abkowitz and Cheng (1988) was utilized to calculate the probability of injury to an individual, i, given a release [Eq. (14)].

(14) $P_I = [1 + \exp(-\overline{R}H_i)]^{-1}$,

where

P_I = probability of injury to people in the vicinity of the incident location, and

$\overline{R}H_i$ = human health risk.

The risk to human health is a function of exposure and toxicity of the material that a person has been exposed to. Toxicity can be defined in terms of three factors the probability of harm per unit dose of a material (H), the shape of the dose-response curve (K), and the "severity index" (S). The severity index is a measure of the degree to which a material's effects are likely to threaten survival, or cause irreversible, progressive damage to health. They are combined with the measure of human exposure, dose, d, to yield the human health risk to an individual, i, [Eq. (15)] (Abdowitz and Cheng, 1988).

(15) human health risk $(RH_i) = (H) \times (S) \times (d_i)^K$,

The log transformation of this equation is presented below [Eq. (16)]. This equation is used to calculate the probability of injury to an individual, i, given a release (P_I).

(16) $\overline{R}H_i = \ln H + \ln S + K \ln d_i$,

Values derived by ICF Incorporated (1984) for the probability of harm per unit dose of a material (H), the severity index (S), and the shape of the dose-response curve (K) were used in this study. Values of these variables for anhydrous ammonia were not available. Therefore, values for the chemical acrylonitrile were used. Acrylonitrile was chosen, as this chemical is a combination of nitrogen, hydrogen, and carbon. This combination is similar to anhydrous ammonia, which is composed of nitrogen and hydrogen. The measure of human exposure (d) is dependent on the environmental concentrations of a substance released into the air. Based on atmospheric advection and dispersion, this can be represented by equation 17 (ICF, 1984).

$$(17)\quad C = \frac{R_e}{\pi \sigma_y \sigma_z v},$$

where

C = concentration of constituent at a distance from the point of release (mg/m^3),

R_e = point source release rate of constituent (mg/min),

σ_y = dispersion in lateral direction (meters),

σ_z = dispersion in vertical direction (meters), and

v = mean wind speed (meters/min).

The point source release rate of anhydrous ammonia (R_e) was calculated by taking the total quantity of anhydrous ammonia released divided by 10 (EPA, 1999). The potential impact distances presented by Harwood and Russell (1990) were used for the variables of dispersion in lateral (σ_y) and vertical (σ_z) directions for anhydrous ammonia. Anhydrous ammonia is classified as a nonflammable gas (NFG). Information from the Northern Prairie Wildlife Research Center was used to calculate the mean wind speed in North Dakota (v). Using this information, the concentration of anhydrous ammonia at a distance from the point of release (C) was calculated.

The dose of a chemical received by an exposed individual must be determined in order to estimate the likelihood that the individual will be adversely affected. In general, dose (in mg/kg body weight-day) is obtained by multiplying the human intake of a medium by the concentration of the chemical in the medium. Assuming an average body weight of 60 kg, dose is estimated for air exposure as follows (ICF, 1984) [Eq. (18)].

(18) $d_{air} = 0.28(C_{air})$,

where

d_{air} = dose through air, and

C_{air} = concentration in air.

Once this information is obtained, the Human Health Risk (RH) [Eq. (17)] and the probability of injury to an individual, i, given a release of anhydrous ammonia (P_i) [Eq. (16)], can be calculated based on the shipment size (V). Worst-case scenarios are assumed. Therefore, the entire shipment is assumed to be released during an incident and the capacity information is utilized to calculate the associated release rates.

Harwood and Russell's study (1990) (Table 3.6) was utilized to calculate the impact

Table 3.6. Potential Impact Distances for Various Classes of Hazardous Materials

Hazardous Materials Class	Impact Distance
Combustible Liquid (CL)	0.5 mi all directions
Flammable Liquid (FL)	0.5 mi all directions
Flammable Solid (FS)	0.5 mi all directions
Oxidizer (OXI)	0.8 mi all directions
Nonflammable Gas (NFG)	1.0 mi all directions
Flammable Gas (FG)	0.5 mi all directions
Poison (POI)	1.0 mi all directions
Corrosive (COR)	1.0 mi all directions
Explosives (EXP)	0.5 mi all directions

Source: Harwood and Russell (1990).

area (square miles) on link, j, (A^j). The DOT classifies anhydrous ammonia as a nonflammable gas (NFG). Population density (per square mile) associated with link, j, $[(POP)^j]$ was calculated based on population distribution within each respective county.

Fixed costs for installing a licensed dealer facility of anhydrous ammonia in North Dakota with three storage tanks is displayed in Table 3.7. A capacity of 25,500 gallons of anhydrous ammonia per tank was set. This was reached as only 85% of the tank can be filled, due to pressure constraints. The model will determine where to locate the facilities to minimize the social cost of transport. The facility fixed cost information was received from a producer and marketer of agricultural nutrients and industrial products, and a major retail supplier of agricultural products and services. The company produces and markets nitrogen, phosphate, potash as well as controlled release fertilizers, and micronutrients.

Table 3.7. Licensed Dealer Facility Fixed Costs for Three Storage Tanks

Item Description	Quantity	Unit	Cost per Unit	Cost
Ammonia storage tanks, 30,000 gallons	3	Ea.	$40,000	$120,000
Tank foundations	3	Sets	$12,000	$36,000
Truck riser, dual hook-ups	1	Ea.	$8,000	$8,000
Ammonia compressor w/30 HP motor	1	Ea.	$20,000	$20,000
Ammonia pump w/30 HP motor	1	Ea.	$5,000	$5,000
Ammonia tank valve kits	3	Sets	$10,000	$30,000
Ammonia nurse tanks, 1,500 gallons	60	Ea.	$5,500	$330,000
Piping and valves	1	Lot	$40,000	$40,000
Meters, loadout	3	Ea.	$20,000	$60,000
Safety shower and plumbing	3	Ea.	$4,000	$12,000
Electrical	1	Lot	$50,000	$50,000
Crane	2	Days	$1,500	$3,000
Installation Labor	1000	Hrs.	$80	$80,000
Site work, trenching, driveway, etc.	1	Lot	$25,000	$25,000
Boom Truck	7	Days	$500	$3,500
Office	1	Ea.	$10,000	$10,000
Painting	1	Lot	$30,000	$30,000
Permits	1	Lot	$10,000	$10,000
Total				**$872,500**

Source: Producer and Marketer of Agricultural Products (2006).

Variable costs were not included, as freight is the primary variable cost associated with the distribution of anhydrous ammonia.

Cost per loaded mile for a 5-axle, 42-foot tanker truck, derived from the Jack Faucett Associates/SYDEC study for the Federal Highway Administration (FHWA), was utilized for the parameter of the manufacturers transportation cost per mile. The costs reflect projected 1995 operational and labor conditions and were stated in 1993 dollars. The consumer price index (CPI) was employed to calculate this value in terms of 2004 dollars. This conversion resulted in a manufacturer transportation cost of $3.45 per loaded mile. This figure may be a misrepresentation of the manufacturers transportation cost, as the costs of energy have increased greater than the CPI from 1993 to 2004. In an attempt to capture this variability, results from a sensitivity analysis on this parameter are presented later in this thesis.

The cost of transporting anhydrous ammonia from a licensed dealer to a farm consists of fuel, non-fuel, and labor expenses. The cost of fuel is equal to the rate of consumption of the fuel, multiplied by the price per gallon of the fuel. The rate of consumption is based on how fast the truck is traveling. This is depicted in Table 3.8, from the California Air Resources Board's Motor Vehicle Emission Inventory (MVEI) models, and consumption-by-speed relationships modeled in the Highway Economic Evaluation Model (HEEM). As the speed limit for transporting anhydrous ammonia is set at 25 miles per hour, the fuel consumption rate for that speed was utilized. This value was then doubled, given the fact that the truck is hauling a nurse tank and up to 1,275 gallons of anhydrous ammonia. Therefore, the fuel consumption rate will be greater than the 0.12 gallons per mile traveled. This resulted in a fuel consumption rate of 0.24 gallons per mile

Table 3.8. Fuel Consumption Rates

Speed	Truck (gallons/mile)
5	0.310
10	0.181
15	0.135
20	0.118
25	0.120
30	0.133
35	0.156
40	0.185
45	0.223
50	0.264
55	0.316
60	0.374
65	0.439
70	0.511

Source: California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) (2004).

traveled. This value was then multiplied by the average price paid by farmers, located in the Northern Plains, in 2004 for unleaded fuel of $1.76 per gallon. This resulted in a value of 0.42 cents per mile for fuel. Non-fuel-related expenses include the costs of oil, tires, maintenance and repairs, and depreciation. Fixed cost-per-mile estimates for trucks from the California Life-Cycle Benefit/Cost Analysis Model were utilized for this study (0.24). The California Life-Cycle Benefit/Cost Analysis Model employs a fixed cost-per-mile, plus an additional estimate for depreciation. The value for a standard truck was doubled, given the fact that in this study the truck is hauling a nurse tank and up to 1,275 gallons of anhydrous ammonia, which in turn can result in an increase in maintenance, oil, tires, and repairs. This increase resulted in a value of $0.48 per mile for non-fuel related expenses. The final aspect of the farmers travel expenses is labor. To capture this value, the average farm work rate for hired labor in North Dakota, for 2004 (North Dakota Agricultural Statistics Book, 2005), was used for the parameter of the driver's salary ($9.85 per hour).

This value was then divided by 25 miles, as the mandated speed limit is 25 miles per hour, to reach a labor cost per mile of $0.39 per mile traveled. Table 3.9 depicts the value of each aspect of the farmer's transportation expense. Summing these expenditures equals the cost per loaded mile of transporting anhydrous ammonia for a farmer of $1.38 per mile.

Table 3.9. Farmers' Transportation Expenses

Phase of Transportation Expense	Transportation Expense (per mile)
Fuel Transportation Cost	$0.42
Non-Fuel Related Transportation Cost	$0.48
Labor Transportation Cost	$0.39
Cost Per Loaded Mile	$1.38

CHAPTER IV

RESULTS

This chapter reports results, presents analysis of the cost minimization models and sensitivity analysis performed on selected variables, and offers interpretations. The chapter consists of four sections. The first section reviews and presents support for the parameter values utilized in this study. In the second section, results of the minimization of social cost model for each county are presented and discussed, along with results of the private cost model for the central county. Also, in this section, the social cost stylized results for each county are compared and contrasted with the actual transportation infrastructure in place throughout North Dakota. In the third section general observations associated with the attained results are discussed. Finally, in the fourth section results and discussion of the sensitivity analysis on selected parameters are presented.

Parameter Values

The parameter values in Chapter III are broken up into four sections, which include county values, licensed dealer values, risk parameters, and transportation variables. Table 4.1 displays the parameters utilized for the constructed counties and their sources. To calculate the parameters of each constructed county, averages of the actual counties were used. The quantity demanded of anhydrous ammonia per county was a combination of the counties crop composition (U.S. Department of Agriculture, 2006), application rates for nitrogen per crop (North Dakota Agricultural Statistics Annual Book, 2005), and the percent of nitrogen, which consists of anhydrous ammonia application (Frazen, 2006). Totals for anhydrous ammonia application in North Dakota were not readily available. That is why a percentage of total nitrogen used within North Dakota was utilized to represent anhydrous ammonia consumption. This percentage (50%) was received from Dr. Dave Franzen, an extension soil specialist at the North Dakota Extension Service.

Table 4.1. County Parameters

Parameter	Source
Square Mileage	U.S. Census Bureau
Population (total, rural, urban)	U.S. Census Bureau
Crop Composition	U.S. Department of Agriculture
Anhydrous Ammonia Quantity Demanded	Franzen, North Dakota Extension Service etc.

The parameters included in the construction of the representative licensed dealers of anhydrous ammonia, in North Dakota, and their sources are displayed in Table 4.2. The capacity and fixed costs of the licensed dealers were contingent on the number of storage tanks located at each site. Each storage tank has a capacity of 30,000 gallons, of which 85% is capable of being utilized given pressurized constraints. Licensed dealer information was received from a producer and marketer of agricultural nutrients and industrial products, and a major retail supplier of agricultural products and services. This producer had compiled cost estimates for constructing a new licensed dealer facility of anhydrous ammonia within North Dakota.

Table 4.2. Licensed Dealer Parameters

Parameter	Source
Capacity	Producer and Marketer of Agricultural Products
Fixed Cost	Producer and Marketer of Agricultural Products

Table 4.3 presents the parameters and their sources used in the representation of risk utilized within this study. The process of calculating the probability of a hazardous material accident was derived from the Federal Highway Risk Assessment Model, presented by Hardwood and Russell (1990). This model includes a combination of the accident rate per vehicle-mile, the length of the route segment in question, and the fraction

Table 4.3. Risk Parameters

Parameter	Source
Probability of Hazardous Material Accident	Federal Highway Risk Assessment Model
Average Fatalities Per Accident	Office of Hazardous Materials Safety
Average Cost of Fatalities in Dollars	National Safety Council
Average Injuries to Individuals in Accident	Office of Hazardous Materials Safety
Average Cost of Injuries in Dollars	Grand Forks Herald
Average Damage to Property per Accident	Office of Hazardous Materials Safety
Probability of Injury to People in the Vicinity	ICF Incorporated
Shipment Size	HMIR; Weber, New Vision Co-op
Impact Area	Federal Highway Risk Assessment Model
Population Density	U.S. Census Bureau

of accidents that involve a hazmat release. It was assumed that manufacturers traveled on a combination of arterial and collector roadways, while farmers traveled on a combination of collectors and local roadways. These assumptions were derived as manufacturers can travel at higher speeds (normal speed limits), while farmers can only travel at the mandated 25 miles per hour, according to North Dakota policy. Given this assumption, accident rates per vehicle mile traveled on each roadway combination were calculated for manufacturers and farmers. Vehicle miles traveled for each road type were collected from the Federal Highway Administration, while accidents per road type were received from the North Dakota Department of Transportation. The numbers of hazardous material accidents by roadway travel for North Dakota were collected from the Office of Hazardous Materials Safety. This was utilized to calculate the fraction of accidents involving a hazmat release within North Dakota. Once this information was collected, the probability of a hazardous material accident per mile traveled within North Dakota, for both the manufacturer and licensed dealer, was calculated.

Information collected from the Office of Hazardous Materials Safety was utilized to calculate the average fatalities per accident, average injuries to individuals in a hazardous material accident, and average damage to property per hazardous material accident. This is a good representation of these parameters, given the information dealt solely with anhydrous ammonia incidents and the database contained strictly hazardous material accident information. Information representing the average cost of fatalities in dollars was collected from the North Dakota Department of Transportation, which received the information from estimated figures published by the National Safety Council. Settlement figures from a 2002 release of anhydrous ammonia in Minot, North Dakota, were employed for the average cost of injuries in dollars. As worst-case scenarios were assumed in this model, the highest current settlement to an individual injured in that release was utilized. The probability of injury to people in the vicinity of an anhydrous ammonia leak is dependent on the population density and shipment size. Shipment size for manufacturers was set at 30 tons per trip. This was determined from the Hazardous Materials Incident Reporting system, which indicates the type of storage technology being utilized by the transporter, and the amount being transported. There were cases where transporters were hauling larger and smaller amounts than 30 tons. However, based on averages, it was concluded that this was a good representation of the average amount shipped per manufacturer trip. North Dakota policy states that farmers can only transport one full nurse tank per trip. Nurse tanks can range in capacity from 1,000 to 2,000 plus gallons. Based on discussions with Dennis Weber, an Agronomy Operations Manager at New Vision Co-op, 1,500 gallon nurse tanks are more widely seen. Impact area was collected from the Federal Highway Risk Assessment Model, presented by Hardwood and Russell (1990). The population density was calculated based on population composition collected from the U.S. Census Bureau. Using these values, along with the techniques presented by Abkowitz and Cheng (1988) and ICF Incorporated (1984), the probability of injury to people in the vicinity of a release was determined.

The transportation parameters include variables for the calculation of the manufacturers' and farmers' transportation expenses. Table 4.4 displays the transportation expense parameters and their sources. The manufacturers' transportation cost per loaded mile was derived from a study conducted by Jack Faucett Associates/SYDEC study for the Federal Highway Administration (FHWA). The costs represent the operational and labor conditions of transporting material with a 5 axle, 42 foot tanker truck. This value is a good representation of the transportation cost of the manufacturers, as the make of the truck is very similar to that which is widely utilized to transport anhydrous ammonia. The farmers transportation cost per loaded mile was calculated based on a combination of fuel, non-fuel, and labor expenses. Information from the California Air Resources Board's Motor Vehicle Emission Inventory (MVEI) models, and consumption-by-speed relationships modeled in the Highway Economic Evaluation Model (HEEM), was utilized to represent the rate of fuel consumption for the farmer. This was then used with information from the North Dakota Agricultural Statistics Book for the average price per gallon of unleaded fuel, in the Northern Plains, to calculate fuel cost, based on distance traveled. Information from the California Life-Cycle Benefit/Cost Analysis Model for non-fuel, fixed-cost-per-mile estimates for trucks, was utilized for non-fuel related expenditures per mile for farmers. Information from the North Dakota Agricultural Statistics Book was utilized to calculate labor cost per mile. This value was then adjusted to compensate for the fact that the farmer was hauling a nurse tank, and up to 1,275 gallons of anhydrous ammonia.

Table 4.4. Transportation Parameters

Parameter	Source
Manufacturers Transportation Cost	Federal Highway Administration
Farmers Transportation Cost	Vehicle Operating Cost Methodology

Results of the Cost Minimization Models

The minimization of the total social cost of transporting anhydrous ammonia was solved for each constructed county. The minimization of total cost (excluding social cost) has been solved for the central county. The minimization of total cost was only performed on the central county. It was concluded that results for the additional two counties would be similar, given the parameters utilized. Therefore, it would not be beneficial to present them in this study. Figures 4.1, 4.2, and 4.3 depict the results obtained by minimizing the social cost of transporting anhydrous ammonia within the western, central, and eastern counties. Figures 4.4 and 4.5 present the results obtained, by minimizing the private cost and doubling the value of social cost for transporting anhydrous ammonia in the central county.

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Figure 4.1. Western County: Minimization of Social Cost.

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Figure 4.2. Central County: Minimization of Social Cost.

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Figure 4.3. Eastern County: Minimization of Social Cost.

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Figure 4.4. Central County: Minimization of Private Cost.

The difference between the results obtained for minimizing the social cost, and the private cost, of transporting anhydrous ammonia within the central county are negligible. As Figures 4.3 and 4.4 display, the number (11) of licensed dealers did not change when

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Figure 4.5. Central County: Increase in Social Cost.

social cost was excluded. The primary dissimilarity was the location of licensed dealers throughout the county. This variability was minimal, as the results for both models primarily situated the licensed dealers near a manufacturer's entrance. The main reason for the minimal disparity between the two models is that social cost is dependent on the accident rates of North Dakota road ways. For manufacturers, it was assumed that they transported their materials on a combination of collectors and arterial roadways. For farmers, a similar assumption was made of a combination of local and collector roadways. Based on accident rates and vehicle miles traveled on these road types from 2000 to 2004, an accident rate per million vehicle miles was calculated. For manufacturers an accident rate of 2.70 accidents per million vehicle miles traveled was calculated. And for farmers, an accident rate of 2.13 accidents per million vehicle miles traveled was reached. This is not a very high accident ratio for manufacturers or farmers. The accident ratios were then multiplied by the fraction of hazardous material incidents per accident (0.0014). This resulted in an even smaller rate of hazardous material incidents per million vehicle miles traveled of 0.0037 for manufacturers and 0.0029 for farmers. The distance hauling anhydrous ammonia by a manufacturer or farmer in each stylized county did not exceed 100 miles. This resulted in a very small probability of an incident in each constructed county. A low probability of an incident translated into a low social cost. Even when the social cost variables were doubled (Figure 4.5), the number of licensed dealers remained constant, with only a slight variation in their location.

Figure 4.6 presents the actual number of licensed dealers of anhydrous ammonia per North Dakota county. On average, there are approximately 6 licensed dealers per western and central counties, and approximately 8 per eastern county. There is a significant disparity between the number of licensed dealers, determined by the model for each county (western 12, central 11, and eastern 14), and the actual average number. A possible explanation for this is that the initial start up costs, or initial fixed cost, for each licensed dealer in the stylized model may not be accurate. This value may be under estimated. Some additional explanations may be that the capacities at the actual plants are greater than what was utilized in the model. Or, the quantity demanded per each constructed county for anhydrous ammonia is greater than the actual quantity demanded per county. Sensitivity analysis results will be discussed later, that evaluate a few of these possibilities.

Results depicting the number of trips from each farm to each licensed dealer, the number of trips from each manufacturer entrance to each licensed dealer location, gallons of anhydrous ammonia supplied to each farm from each licensed dealer, and the gallons of anhydrous ammonia supplied to each licensed dealer from each manufacturer entrance for all of the scenarios discussed are presented in Appendix B. The primary conclusion drawn from these results is that, when possible, the farms receive a majority, if not all, of their anhydrous ammonia from the licensed dealer that is situated closest to their location. However, this was not always the case, given capacity constants of the dealers and demands of the farmers. Similarly to the farmers, the licensed dealers received a majority of their anhydrous ammonia from the manufacturer entrance, which was situated closest to their location. The simple explanation for this is that the fewer miles that farmers or manufacturers have to travel, the lower the cost and social cost will be.

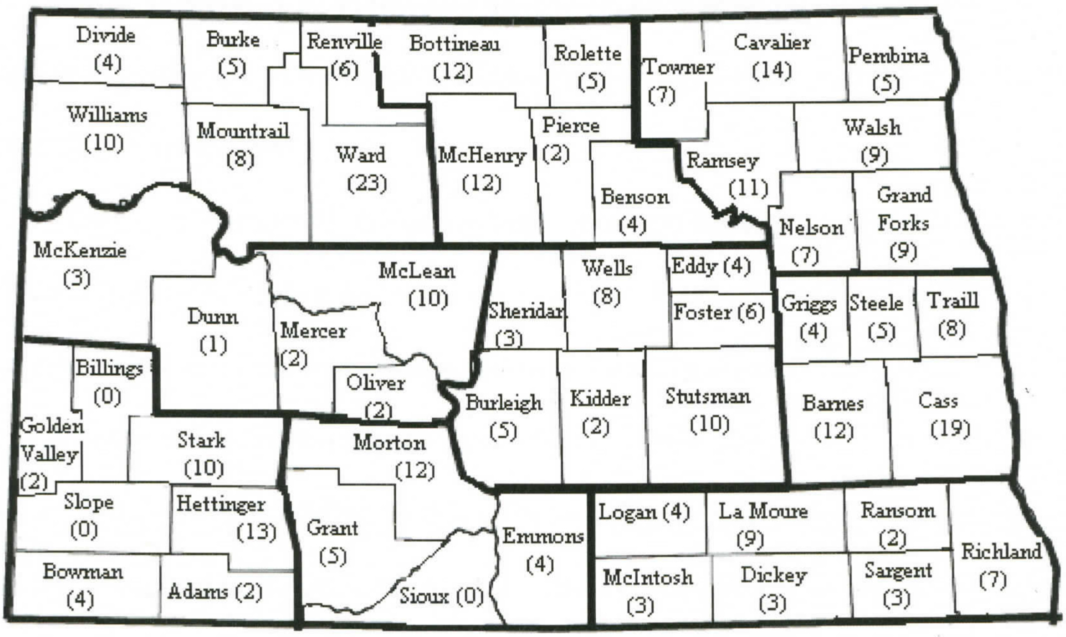

Figure 4.6. North Dakota Licensed Dealers of Anhydrous Ammonia per County.

General Observations and Policy Discussion

After a review of the above results, a few general observations were reached. A possible reason for the insignificant difference between the results of the private and social cost model, and private cost model, is that North Dakota is so sparsely populated that a release of anhydrous ammonia would only impact a small population. A lower affected population reduces the potential consequences of a release, which in turn, lowers the total social cost of transporting anhydrous ammonia. Additionally, the sparse population could also affect the probability of an accident. When there are fewer cars on the road, there will be less congestion and consequently a lower number of accidents. This could be a major reason behind why the probability of an accident is so low in North Dakota. Another possible explanation behind the low probability of an accident is the fact that a majority of North Dakota roadways are mainly straight with limited curves. Earlier in this paper it was noted that the probability of a jackknife increases significantly on curved roadways. Limiting the curvature of the roadways throughout North Dakota would also lower the probability of an accident.

There is a noteworthy difference between the stylized results and actual average number of licensed dealers throughout each county. There are a number of possible explanations for this outcome. One possibility is that the quantity demanded of anhydrous ammonia in each county is overestimated. This in turn would drive up the number of licensed dealers in each county, so that there would be an infrastructure that could meet the quantity demanded of its farmers. An additional explanation is that the capacity levels of the actual plants are greater than what was assumed in the model. This, of course, would result in a scenario where a lower number of licensed dealers would be necessary to fulfill the farmers' needs. Another possibility is that there are fewer licensed dealers of anhydrous ammonia throughout North Dakota than what would be optimal for minimizing the total social cost of transport. This, in turn, could result in an incentive for farmers to increase the speed at which they travel, as the locations of licensed dealers would be sparsely located. Farmers would have to travel farther, and consecutively be more likely to travel faster than the mandated twenty five miles per hour speed limit. As farmers surpass the speed limit, the probability of an accident increases, and in relation, so does the probability of an anhydrous ammonia incident. However, based on the accident statistics, there is no evidence that a high number of incidents are occurring. Farmers could still be traveling too fast. However, farmers are most likely traveling on roadways that they are very familiar with. Therefore, they may be able to maneuver on them at a higher rate of speed, without increasing their potential of an accident. Overall, based on the results received, there is no legitimate reason to question that farmers are acting irrationally during transport, and that the current transportation infrastructure for anhydrous ammonia throughout North Dakota is an inferior solution.

Sensitivity Analysis of Parameters

Sensitivity analysis was performed on a few parameters to determine if they are affecting the optimal solution for the central county. The first parameter evaluated was the fixed costs of initializing a licensed dealer facility. The fixed cost utilized in the model was increased and decreased by fifty-percent. Figures 4.7 and 4.8 display an increase and decrease of this value. As you can see, the number of licensed dealers in the central county did not change (11) in either situation. The only difference was the value of the objective function and location of licensed dealers. The fluctuation in the value of the objective function would be expected, given the change in fixed cost.

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Figure 4.7. Central County: Increase in Fixed Costs.

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Figure 4.8. Central County: Decrease in Fixed Costs.

The manufacturers' transportation cost was also evaluated. Similarly to the fixed cost, the manufacturers' transportation cost was also increased and decreased by fifty-percent. The results of an increase in the manufacturers' transportation cost are depicted in Figure 4.9, and a decrease is displayed in Figure 4.10. Once again, the number of licensed dealers was not affected (11). However, the location of the licensed dealers, and objective value did fluctuate. The change in the value of the objective function would be expected, given the change in the cost. However, a clear explanation as to why the location of licensed dealers altered was not reached.

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LD												
LD												LD
						LD						LD
						LD						
						LD						

Figure 4.9. Central County: Increase in the Manufacturers' Transportation Cost.

						LD						
					LD	LD						LD
LD												
LD												LD
LD												LD
						LD						
						LD						

Figure 4.10. Central County: Decrease in the Manufacturers' Transportation Cost.

The final parameter studied was the farmers' transportation cost. Just like the previous two parameters, this value was increased and decreased by fifty-percent from its original value. The results of these changes are displayed in Figures 4.11 and 4.12. The optimal number of licensed dealers did not alter from the optimal solution, but the locations and objective value did change.

	LD				LD							
			LD									
												LD
LD					LD							LD
						LD						LD
						LD						
					LD							

Figure 4.11. Central County: Increase in Farmers' Transportation Cost.

						LD						
						LD						
LD												LD
LD												LD
						LD						LD
						LD						
					LD	LD						

Figure 4.12. Central County: Decrease in Farmers' Transportation Cost.

Reviewing the results of the sensitivity analysis, it is apparent that the number of licensed dealers was not affected. Given the values of the other parameters, the cost values assumed are sufficient to determine the optimal configuration of licensed dealers throughout each county. Overall, it appears the quantity demanded of anhydrous ammonia within each county is the primary parameter which is determining the number of licensed dealers to locate within each respective county. While the manufacturers' transportation and incident costs are the key variables which determine where to locate the dealers within the model. This conclusion was reached as the manufacturers' transportation costs and incident costs are greater than the farmers. Therefore, the model will want to minimize the distance traveled by each manufacturer before considering the farmers transportation costs. This is apparent in the results, as a majority of the licensed dealers are located near a manufacturers' entrance.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter summarizes the research project and draws conclusions about the results obtained from this study. The first part of this chapter reviews the need for study, research objectives, and methods of the study. Conclusions and implications drawn from the research are discussed in the next section, followed by the limitations of this study. The final section discusses the need for further study.

Reasons for Study

A transportation infrastructure that recognizes transportation costs and potential incident scenarios for the hauling of anhydrous ammonia within North Dakota is necessary for several reasons. First of all, the properties of anhydrous ammonia make it one of the most potentially dangerous chemicals used in agriculture. Therefore, precautions need to be taken to minimize the would-be devastating situations where anhydrous is released into the surrounding communities and environment. This can be achieved by strategically locating licensed dealers of anhydrous ammonia within a county.

Given that the commercial transportation of anhydrous ammonia is highly regulated, and the non-commercial transportation is subject to the risk acceptance of rural farm drivers, there might be a socially disadvantageous under-utilization of commercial transport and over-utilization of farm transportation. This would potentially lead to high risk of damages from hazardous material transportation, if farm drivers do not internalize the external risk of accidents upon others.

The transportation of anhydrous ammonia involves costs, and poses some risk to the transporter, surrounding communities, and environment. Whereas commercial transport is regulated, a farmers transport is not easily monitored, which may result in a higher degree of risk. Therefore, an optimal configuration of licensed anhydrous ammonia dealers, based upon numerous assumptions, is a valuable tool in understanding the impact of current incentives and regulations upon the transporter, surrounding communities, and the environment.

The objectives of this study were to assess the impacts of regulatory, environmental, and economic incentives of transporting anhydrous ammonia within North Dakota. This was achieved by constructing and presenting a mathematical model, which can be used as a tool to select the location of licensed dealers of anhydrous ammonia within a county, so that anhydrous ammonia is managed with minimum social cost. Results for the minimization of the social cost, and private cost, of transporting anhydrous ammonia were compared and contrasted. Furthermore, the stylized optimization results were compared to North Dakota's existing anhydrous ammonia distribution network.

Conclusions and Implications

The figures presented in the Results chapter demonstrate that social cost may not be a significant factor in the location of licensed dealers of anhydrous ammonia, within a given North Dakota county. The results for the central county showed that the location of licensed dealers did not substantially change when the model was run with and without the social cost factor. This is due to the low risk and limited impacts of anhydrous ammonia spills in North Dakota. Farmers transport their inputs from dealers to their farms on straight roads with little traffic. Traffic congestion is very limited in rural areas, due to the sparse population. Also, farmers are transporting anhydrous ammonia on roads they are most likely very familiar with. All of these factors result in a very low probability of an accident, and therefore an anhydrous ammonia incident by farmer transport. Some of these circumstances also help to lower the probability of an accident/incident during the manufacturers' transportation phase of the infrastructure. As was the case for farmers, manufacturers are mainly transporting anhydrous ammonia through sparsely populated areas, with little traffic. As was indicated in the regulations section of this study, commercial carriers must be trained and have a hazmat endorsement to be able to transport hazardous material. Drivers that are hazmat trained have a higher level of preparedness to handle the aspects of transporting hazardous material, which helps to lower the probability of an accident/incident. Incident costs are relatively low, due to low population density. Just as the sparse population of North Dakota lowered the probability of a hazmat accident/incident, it also lowers the potential consequences, if a release were to occur.

As the results show, the majority of licensed dealers for each county were primarily situated near a manufacturer's entrance. This occurred due to the relative costs of commercial and farmer transport. As was presented in Chapter III, the transportation costs for the manufacturer ($3.45 per loaded mile) was significantly higher than that of the farmers' ($1.38 per loaded mile). Many factors influence the manufacturers' transportation cost per loaded mile. These include the number of trailers in the configuration, the cost and useful lives of the trailers and tractors, the payload capacity, fuel efficiency ratings, and driver pay and premiums. All of these factors impact the ton-mile costs (Tolliver, 1997). Another possibility behind the fluctuation between the manufacturers' and farmers' transportation cost is the fact that the regulations associated with the commercial transportation of hazardous material lowers the pool of potential carriers of the material. As the laws of supply and demand state, as the supply decreases the price will increase.

We can conclude that as the number of potential carriers of hazardous material decreases, the wage they receive will increase. This results in the price per loaded mile of transporting hazardous material to increase as well. Sensitivity analysis was performed on these parameters to evaluate this possibility, and no significant difference in results was reached.

As discussed earlier, there are a few possible reasons for the small difference between the results obtained from the social cost and private cost models. One possibility is that the parameters in the model may not have adequately represented the current real life situations. However, sensitivity analysis did not have an affect on the results. So, this possibility may not be significant. Another possible explanation is that the quantity demanded for anhydrous ammonia in each county was over estimated, or that the capacities at each plant may be less than the current technologies being utilized. All of these are legitimate concerns associated with the performance of the model.

In Chapter IV, the stylized results for the minimization of social cost for each county was compared and contrasted to the actual average configuration of licensed dealers in each area of North Dakota. As was indicated previously, there is a significant difference between the actual number and the stylized results reached in this study. When initially preparing this research, a hypothesis was that the distance constraint presented in Chapter III would result in a scenario where more licensed dealers would be needed in each county to allow farmers to obey the anhydrous ammonia transportation policies of North Dakota. However, given the dimensions of the constructed counties, it turned out that the distance constraint was not binding and would not affect the results. Another possible reason behind the discrepancy is that in this model it was assumed that licensed dealers were only concerned with the distribution of anhydrous ammonia. In reality, this is not the case. A majority of anhydrous ammonia licensed dealers also run as grain elevators, and perform other farm related services. Therefore, anhydrous ammonia distribution is not always the primary concern of decision makers when making facility and distribution related decisions. This may result in a scenario where the number of licensed dealers of anhydrous ammonia is lower than what would be optimal to meet quantity demanded, and also, minimize the social cost of transport to society and the environment.

Overall, the primary conclusion drawn from this study is that the probability of an anhydrous ammonia incident within North Dakota is very small, which in turn lowers the overall social cost of transporting this material. With social cost being so low, the model situated the location of licensed dealers close to the manufacturers' entrances. As the manufacturers' transportation cost and incident costs were higher per mile than the farmers. This resulted in farmers transporting the material longer distances than manufacturers. This in turn could possibly result in a scenario where farmers have an incentive to disobey the current North Dakota policies, which would increase the likelihood of anhydrous ammonia incidents. However, based on current accident probabilities, there is no indication that this scenario is occurring. But one must keep in mind that many hazardous material incidents are not reported. And as the circumstances for obeying the mandated policies become increasingly difficult to follow, we could eventually see a scenario where a major incident would need to occur before action would be taken, i.e. the Minot incident of 2002.

The results indicate that the current regulatory structure associated with the transportation of anhydrous ammonia is sufficient to limit incidents. However, as long as there are only a few sparsely located licensed dealers of anhydrous ammonia, the probability of an incident will increase. This occurs as farmers and manufacturers must travel farther and farther with the product, thereby exposing the community and the environment to higher degrees of risk.

Limitations and Suggestions for Further Study

The probability of an anhydrous ammonia incident may be low, but there are additional precautions that may lower this risk even further, which would protect the communities and environments for which this product is transported through. Other possible precautions that could be further researched include the limitations of routes which anhydrous ammonia may be transported on. Limiting the routes so they are situated in densely populated areas and avoid highly populated urban areas would help to limit the possible affects of an anhydrous ammonia release. Limiting the road types that anhydrous ammonia is transported on so they only include types with very low probabilities of accidents, may also help to reduce the possible devastating affects of an anhydrous ammonia leak.

It is clear that as long as anhydrous ammonia is transported there will be certain risks to the community and environment. To minimize these risks, regulatory policies must be implemented and enforced to ensure safe and prosperous communities within North Dakota.

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APPENDIX A

Regulatory Actions Required for the Transportation of Hazardous Material

There are many precautions and regulatory actions that must be conducted associated with the transportation of hazardous material. This section will specify and evaluate the necessary actions that must be taken at the shipper, the carrier, the commercial driver, and the community levels to ensure the safe transportation of hazardous material.

The actions of the shipper associated with hazmat include sending the hazardous material from one specified location to another by truck, rail, vessel, or airplane. The shipper must also determine the product's proper shipping name, hazard class which reflects the associated risk, identification number, correct packaging, correct label/markings, and correct placards consistent with hazardous material regulations. Another responsibility of the shipper is to prepare shipping papers, which describe the hazardous material being shipped; provide emergency response information; and certify that the shipment has been prepared according to the hazardous material transportation regulations (U.S. DOT, Undated2).

Facilities wishing to treat, store, or dispose of hazardous material/waste are required to submit permit applications to the EPA under subtitle C of The Resource Conservation and Recovery Act (RCRA). Owners and operators of hazardous material/waste management facilities are required to have the permit throughout the active life of the hazardous material/waste. Permit applications must include a characterization of the hazardous material/wastes to be handled by the facility, demonstration of compliance with standards and regulations that apply to the facility, information on the potential for the public to be exposed to the hazardous material/waste through releases, and a contingency plan. In the case when there is any potential for danger to human health or the environment, the permitted has twenty-four hours to orally report the circumstances. A written submission is also required that contains a description of the cause of the incident; dates and times of the incident; and steps taken to reduce, eliminate, and prevent reoccurrences of the incident. Permits will be terminated if the permitted displays any noncompliance with the conditions of the permit, the permitted fails to fully disclose all relevant facts throughout the permit application process, or if the permitted activity endangers human health or the environment and can only be regulated through termination of the permit (U.S. DOT, 1975).

Opportunities for comment by local governments and the public on the facility contingency plan are required. It is important that local emergency response authorities be familiar with contingency plans of these facilities. Coordination with local community emergency response agencies is required by regulations, and the EPA strongly encourages active community coordination of local response capabilities with facility plans. RCRA permits are not required by response personnel when there is a discharge of hazardous material/waste; an imminent threat of a discharge; or an immediate threat to human health, public safety, property, or the environment.

Any person is subject to federal hazardous material transportation law that transports, manufactures, fabricates, marks, maintains, reconditions, repairs, or tests a package or container that contains hazardous material. Violators of the Federal hazardous material transportation law are liable for a civil penalty of up to $32,500, and no less than $275 for each violation (U.S. DOT, 1975).

Under Federal regulation, employers must provide training to employees who will be handling hazardous material. Training requirements include the following: general awareness/familiarization training, function-specific training, safety training, and security awareness training. As of December 22, 2003, each employee of an employer, that is required to have a security plan, must receive training concerning the security plan and its implementation. Training is to be administered to hazmat employees at least once every three years (U.S. DOT, Undated1).

Effective as of September 25, 2003, each person who offers transportation or transports hazardous material that meet any of the following specifications: transports a highway route-controlled quantity of radioactive material; transports more than 55 pounds of a Division 1.1, 1.2 or 1.3 explosive; transports more than one liter per package of a material poisonous by inhalation; transports hazardous material in excess of 3,500 gallons for liquids, or 468 cubic feet for solids; and transports a shipment in other than a bulk packaging of 5,000 pounds or more, must develop and adhere to a security plan. The security plan must include an assessment of possible transportation security risks, measures to confirm information provided to employees that have access to hazardous material, measures to assess the risk that unauthorized persons might gain access to the hazardous material, and measures to assess the security risks of shipments. The security plan must be written and retained as long as it stays in affect (U.S. DOT, Undated1).

The responsibilities of the carrier related to hazmat consist of taking the shipment for the shipper to its destination; checking that the shipper correctly described, marked, labeled, and overall prepared the shipment for transportation; and report accidents and incidents involving hazardous material to the proper government agency.

Carriers, and in some cases shippers, specialize in the management of hazardous material/waste to ensure that they are handled properly, by offering treatment that includes on-site services at industrial plants, oil collection and recovery, transportation, disposal services, laboratory chemical management services, and industrial services.

Commercial drivers of hazardous material must make sure the shipper has identified, marked, and labeled the hazardous material properly; placards his vehicle; obeys all rules regarding hazmat; and keeps hazardous material, shipping papers and emergency response information in their designated location. Emergency response information must include the following: the basic description and technical name of the hazardous material, immediate hazards to health, risks of fire or explosion, immediate precautions to be taken in the event of an accident or incident, immediate methods for handling fires, initial methods for handling spills or leaks in the absence of fire, and preliminary first aid measures. An emergency response telephone number must also be provided. The driver must have a commercial driver license (CDL), with a hazardous material endorsement. The Transportation Security Administration (TSA) has recently initiated new licensing rules for hazmat drivers. Since January 31, 2005, all new drivers must undergo TSA and Federal Bureau of Investigation (FBI) background checks, prior to receiving a hazardous material endorsement. And as of May 31, 2005, licensees seeking a renewal will be subject to the same policies (CRS, 2005).

Commercial drivers must sign and carry a Uniform Hazardous Waste Manifest. The Uniform Hazardous Waste Manifest is a form prepared by all generators who transport or offer transport. It is a portion of the Hazardous Waste Manifest System. The Hazardous Waste Manifest System is a set of forms, reports, and procedures designed to track hazardous material/waste throughout the transportation phases. The system enables the waste generator to verify that the waste has been delivered properly with no complications (EPA, Undated).

The following requirements may be applicable to the shipper, commercial driver, or carrier. Federal regulations associated with the transportation of hazardous material require immediate notice of certain hazardous material incidents. This includes when a person is killed, a person receives injuries requiring hospitalization, carrier or property damage exceeds $50,000, evacuation of the general public occurs lasting one or more hours, one or more major transportation arteries are closed or shut down for more than one hour, and the operational flight pattern or routine of an aircraft is altered. Notification is also required when fire, breakage, spillage, or suspected contamination occurs, involving a shipment of radioactive material, or infectious substances. Contact is also warranted when a release of a marine pollutant occurs in a quantity exceeding 119 gallons for liquids, or 882 pounds for solids, and if a situation exists of such a nature that, in the judgment of the carrier, it should be reported to the National Response Center, even though it does not meet any previous criterias. If any of the above scenarios occur, notification should be made to the National Response Center as soon as practical, but no later than 12 hours after the occurrence. Written hazardous material incidents reports must also be completed within 30 days from the incident and submitted to the DOT. The DOT requires a copy of the hazardous waste manifest, an estimate of the quantity of the waste removed from the scene, the name and address of the facility to which it was taken, and the manner of disposition for any removed waste (U.S. DOT, Undated2).

The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) makes it mandatory for Local Emergency Planning Committees (LEPC) to prepare an emergency plan for possible releases of hazardous material. LEPC members include elected state and local officials, law enforcement, firefighting, health, local environmental, hospital and transportation personnel, broadcast and print media, community groups, and owners and operators of facilities subject to the requirements of EPCRA. Each emergency plan must include facilities; local emergency, and medical personnel; the names of community and facility emergency coordinators; procedures for notifying officials and the public in the event of a release; methods for detecting a release and identifying areas and populations at risk; a description of emergency equipment and facilities in the community and at specified fixed facilities; evacuation and shelter-in-place plans; training programs; and schedules for exercising the emergency plan (EPA, 2001).

There are many factors that communities must take into consideration when constructing their emergency plans. Factors include the size of the community, the level of danger, and preparedness for planning. Steps in the plan preparation include determining if a plan is needed; assessing response capabilities; assessing community response capabilities; developing or revise hazardous material emergency plan; and revising, testing and maintaining the plan.

APPENDIX B

Table B.1. Western County: Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION												
		x1.y2	x1.y7	x2.y13	x3.y8	x3.y13	x4.y1	x4.y13	x5.y13	x6.y5	x6.y7	x7.y6	x7.y7	Total
FARM LOCATION	x1.y1	1	12	0	0	0	0	0	0	0	0	0	0	13
	x1.y2	1	12	0	0	0	0	0	0	0	0	0	0	13
	x1.y3	0	13	0	0	0	0	0	0	0	0	0	0	13
	x1.y4	5	8	0	0	0	0	0	0	0	0	0	0	13
	x1.y5	6	7	0	0	0	0	0	0	0	0	0	0	13
	x1.y6	1	12	0	0	0	0	0	0	0	0	0	0	13
	x1.y7	13	0	0	0	0	0	0	0	0	0	0	0	13
	x1.y8	1	12	0	0	0	0	0	0	0	0	0	0	13
	x1.y9	1	12	0	0	0	0	0	0	0	0	0	0	13
	x1.y10	9	4	0	0	0	0	0	0	0	0	0	0	13
	x1.y11	3	10	0	0	0	0	0	0	0	0	0	0	13
	x1.y12	10	3	0	0	0	0	0	0	0	0	0	0	13
	x1.y13	13	0	0	0	0	0	0	0	0	0	0	0	13
	x2.y1	0	0	13	0	0	0	0	0	0	0	0	0	13
	x2.y2	1	0	12	0	0	0	0	0	0	0	0	0	13
	x2.y3	1	2	10	0	0	0	0	0	0	0	0	0	13
	x2.y4	0	2	11	0	0	0	0	0	0	0	0	0	13
	x2.y5	1	0	9	0	3	0	0	0	0	0	0	0	13
	x2.y6	1	0	0	0	12	0	0	0	0	0	0	0	13
	x2.y7	0	0	10	0	3	0	0	0	0	0	0	0	13
	x2.y8	12	0	1	0	0	0	0	0	0	0	0	0	13
	x2.y9	13	0	0	0	0	0	0	0	0	0	0	0	13
	x2.y10	0	0	13	0	0	0	0	0	0	0	0	0	13
	x2.y11	11	0	0	0	2	0	0	0	0	0	0	0	13
	x2.y12	0	0	12	0	1	0	0	0	0	0	0	0	13
	x2.y13	0	0	12	1	0	0	0	0	0	0	0	0	13
	x3.y1	0	0	0	0	12	1	0	0	0	0	0	0	13
	x3.y2	0	0	0	0	13	0	0	0	0	0	0	0	13
	x3.y3	0	0	0	0	9	3	1	0	0	0	0	0	13
	x3.y4	0	0	0	1	0	12	0	0	0	0	0	0	13
	x3.y5	0	0	0	1	12	0	0	0	0	0	0	0	13
	x3.y6	0	0	0	3	0	0	12	0	0	0	0	0	15
	x3.y7	0	0	0	4	12	0	0	0	0	0	0	0	16
	x3.y8	0	0	0	0	4	0	9	0	0	0	0	0	13
	x3.y9	0	0	0	1	12	0	0	0	0	0	0	0	13
	x3.y10	0	0	0	6	0	0	1	6	0	0	0	0	13
	x3.y11	0	0	0	4	0	12	0	0	0	0	0	0	16
	x3.y12	0	0	0	1	0	0	12	0	0	0	0	0	13
	x3.y13	0	0	0	1	9	1	2	0	0	0	0	0	13
	x4.y1	0	0	0	1	0	0	12	0	0	0	0	0	13
	x4.y2	0	0	0	1	0	0	12	0	0	0	0	0	13
	x4.y3	0	0	0	0	0	13	0	0	0	0	0	0	13
	x4.y4	0	0	0	0	0	12	1	0	0	0	0	0	13
	x4.y5	0	0	0	0	0	12	0	1	0	0	0	0	13
	x4.y6	0	0	0	0	0	1	12	0	0	0	0	0	13
	x4.y7	0	0	0	1	0	3	0	0	0	0	0	0	4
	x4.y8	0	0	0	1	0	0	12	0	0	0	0	0	13
	x4.y9	0	0	0	0	0	0	0	13	0	0	0	0	13
	x4.y10	0	0	0	0	0	10	3	0	0	0	0	0	13
	x4.y11	0	0	0	0	0	1	0	11	1	0	0	0	13
	x4.y12	0	0	0	0	0	11	0	2	0	0	0	0	13
	x4.y13	0	0	0	1	0	1	11	0	0	0	0	0	13
	x5.y1	0	0	0	0	0	0	0	6	0	7	0	0	13
	x5.y2	0	0	0	0	0	12	0	1	0	0	0	0	13
	x5.y3	0	0	0	0	0	0	0	0	13	0	0	0	13
	x5.y4	0	0	0	0	0	0	0	12	0	1	0	0	13
	x5.y5	0	0	0	0	0	0	0	11	1	1	0	0	13
	x5.y6	0	0	0	0	0	0	0	12	1	0	0	0	13
	x5.y7	0	0	0	0	0	0	0	1	12	0	0	0	13
	x5.y8	0	0	0	0	0	0	0	6	7	0	0	0	13
	x5.y9	0	0	0	0	0	0	0	8	3	2	0	0	13
	x5.y10	0	0	0	0	0	0	0	0	13	0	0	0	13
	x5.y11	0	0	0	0	0	0	0	13	0	0	0	0	13
	x5.y12	0	0	0	0	0	0	0	0	13	0	0	0	13
	x5.y13	0	0	0	0	0	0	0	0	12	1	0	0	13
	x6.y1	0	0	0	0	0	0	0	0	0	13	0	0	13
	x6.y2	0	0	0	0	0	0	0	0	0	13	0	0	13
	x6.y3	0	0	0	0	0	0	0	0	9	0	0	4	13
	x6.y4	0	0	0	0	0	0	0	0	0	13	0	0	13
	x6.y5	0	0	0	0	0	0	0	0	0	2	0	11	13
	x6.y6	0	0	0	0	0	0	0	0	0	13	0	0	13
	x6.y7	0	0	0	0	0	0	0	0	0	9	4	0	13
	x6.y8	0	0	0	0	0	0	0	0	0	13	0	0	13
	x6.y9	0	0	0	0	0	0	0	0	13	0	0	0	13
	x6.y10	0	0	0	0	0	0	0	0	0	12	0	1	13
	x6.y11	0	0	0	0	0	0	0	0	0	0	13	0	13
	x6.y12	0	0	0	0	0	0	0	0	0	9	4	0	13

Table B.1. (continued)

		LICENSED DEALER LOCATION												
		x1.y2	x1.y7	x2.y13	x3.y8	x3.y13	x4.y1	x4.y13	x5.y13	x6.y5	x6.y7	x7.y6	x7.y7	Total
FARM LOCATION	x6.y13	0	0	0	0	0	0	0	0	0	0	2	11	13
	x7.y1	0	0	0	0	0	0	0	0	0	0	0	13	13
	x7.y2	0	0	0	0	0	0	0	0	0	0	0	13	13
	x7.y3	0	0	0	0	0	0	0	0	0	0	0	13	13
	x7.y4	0	0	0	0	0	0	0	0	0	0	12	1	13
	x7.y5	0	0	0	0	0	0	0	0	0	0	0	13	13
	x7.y6	0	0	0	0	0	0	0	0	0	0	1	12	13
	x7.y7	0	0	0	0	0	0	0	0	0	0	13	0	13
	x7.y8	0	0	0	0	0	0	0	0	0	0	13	0	13
	x7.y9	0	0	0	0	0	0	0	0	0	0	0	13	13
	x7.y10	0	0	0	0	0	0	0	0	0	0	12	1	13
	x7.y11	0	0	0	0	0	0	0	0	0	0	13	0	13
	x7.y12	0	0	0	0	0	0	0	0	0	0	13	0	13
	x7.y13	0	0	0	0	0	0	0	0	9	0	4	0	13
TOTAL		104	109	103	28	104	105	100	103	107	109	104	106	1,182

Table B.2. Western County: Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y2	0	0	18	1	19
	x1.y7	0	0	19	0	19
	x2.y13	0	19	0	0	19
	x3.y8	1	0	0	1	2
	x3.y13	0	19	0	0	19
	x4.y1	19	0	0	0	19
	x4.y13	0	19	0	0	19
	x5.y13	0	19	0	0	19
	x6.y5	0	0	13	6	19
	x6.y7	0	0	0	19	19
	x7.y6	0	0	0	19	19
	x7.y7	0	0	0	19	19
TOTAL		20	76	50	65	211

Table B.3. Western County: Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION												
		x1.y2	x1.y7	x2.y13	x3.y8	x3.y13	x4.y1	x4.y13	x5.y13	x6.y5	x6.y7	x7.y6	x7.y7	Total
FARM LOCATION	x1.y1	1,275	14,400	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y2	1,275	14,400	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y3	0	15,675	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y4	6,375	9,300	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y5	7,650	8,025	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y6	1,275	14,400	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y7	15,675	0	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y8	1,275	14,400	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y9	1,275	14,400	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y10	11,475	4,200	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y11	3,825	11,850	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y12	12,750	2,925	0	0	0	0	0	0	0	0	0	0	15,675
	x1.y13	15,675	0	0	0	0	0	0	0	0	0	0	0	15,675
	x2.y1	0	0	15,675	0	0	0	0	0	0	0	0	0	15,675
	x2.y2	375	0	15,300	0	0	0	0	0	0	0	0	0	15,675
	x2.y3	1,275	1,650	12,750	0	0	0	0	0	0	0	0	0	15,675
	x2.y4	0	1,875	13,800	0	0	0	0	0	0	0	0	0	15,675
	x2.y5	375	0	11,475	0	3,825	0	0	0	0	0	0	0	15,675
	x2.y6	1,275	0	0	0	14,400	0	0	0	0	0	0	0	15,675
	x2.y7	0	0	11,850	0	3,825	0	0	0	0	0	0	0	15,675
	x2.y8	14,400	0	1,275	0	0	0	0	0	0	0	0	0	15,675
	x2.y9	15,675	0	0	0	0	0	0	0	0	0	0	0	15,675
	x2.y10	0	0	15,675	0	0	0	0	0	0	0	0	0	15,675
	x2.y11	14,025	0	0	0	1,650	0	0	0	0	0	0	0	15,675
	x2.y12	0	0	14,400	0	1,275	0	0	0	0	0	0	0	15,675

Table B.3. (continued)

	LICENSED DEALER LOCATION												
FARM LOCATION	x1.y2	x1.y7	x2.y13	x3.y8	x3.y13	x4.y1	x4.y13	x5.y13	x6.y5	x6.y7	x7.y6	x7.y7	Total
X2.y13	0	0	15,300	375	0	0	0	0	0	0	0	0	**15,675**
X3.y1	0	0	0	0	15,178	497	0	0	0	0	0	0	**15,675**
X3.y2	0	0	0	0	15,675	0	0	0	0	0	0	0	**15,675**
X3.y3	0	0	0	0	10,575	3,825	1,275	0	0	0	0	0	**15,675**
x3.y4	0	0	0	375	0	15,300	0	0	0	0	0	0	**15,675**
x3.y5	0	0	0	375	15,300	0	0	0	0	0	0	0	**15,675**
x3.y6	0	0	0	375	0	0	15,300	0	0	0	0	0	**15,675**
x3.y7	0	0	0	375	15,300	0	0	0	0	0	0	0	**15,675**
x3.y8	0	0	0	0	4,200	0	11,475	0	0	0	0	0	**15,675**
x3.y9	0	0	0	853	14,822	0	0	0	0	0	0	0	**15,675**
x3.y10	0	0	0	7,650	0	0	1,275	6,750	0	0	0	0	**15,675**
x3.y11	0	0	0	375	0	15,300	0	0	0	0	0	0	**15,675**
x3.y12	0	0	0	375	0	0	15,300	0	0	0	0	0	**15,675**
x3.y13	0	0	0	1,275	11,475	375	2,550	0	0	0	0	0	**15,675**
x4.y1	0	0	0	375	0	0	15,300	0	0	0	0	0	**15,675**
x4.y2	0	0	0	375	0	0	15,300	0	0	0	0	0	**15,675**
x4.y3	0	0	0	0	0	15,675	0	0	0	0	0	0	**15,675**
x4.y4	0	0	0	0	0	14,400	1,275	0	0	0	0	0	**15,675**
x4.y5	0	0	0	0	0	15,103	0	572	0	0	0	0	**15,675**
x4.y6	0	0	0	0	0	375	15,300	0	0	0	0	0	**15,675**
x4.y7	0	0	0	97	0	3,825	0	0	0	0	0	0	**3,922**
x4.y8	0	0	0	375	0	0	15,300	0	0	0	0	0	**15,675**
x4.y9	0	0	0	0	0	0	0	15,675	0	0	0	0	**15,675**
x4.y10	0	0	0	0	0	11,850	3,825	0	0	0	0	0	**15,675**
x4.y11	0	0	0	0	0	1,275	0	14,025	375	0	0	0	**15,675**
x4.y12	0	0	0	0	0	13,125	0	2,550	0	0	0	0	**15,675**
x4.y13	0	0	0	375	0	1,275	14,025	0	0	0	0	0	**15,675**
x5.y1	0	0	0	0	0	0	0	7,425	0	8,250	0	0	**15,675**
x5.y2	0	0	0	0	0	15,300	0	375	0	0	0	0	**15,675**
x5.y3	0	0	0	0	0	0	0	0	15,675	0	0	0	**15,675**
x5.y4	0	0	0	0	0	0	0	15,300	0	375	0	0	**15,675**
x5.y5	0	0	0	0	0	0	0	14,025	1,275	375	0	0	**15,675**
x5.y6	0	0	0	0	0	0	0	14,475	1,200	0	0	0	**15,675**
x5.y7	0	0	0	0	0	0	0	1,275	14,400	0	0	0	**15,675**
x5.y8	0	0	0	0	0	0	0	7,650	8,025	0	0	0	**15,675**
x5.y9	0	0	0	0	0	0	0	10,200	2,925	2,550	0	0	**15,675**
x5.y10	0	0	0	0	0	0	0	0	15,675	0	0	0	**15,675**
x5.y11	0	0	0	0	0	0	0	15,675	0	0	0	0	**15,675**
x5.y12	0	0	0	0	0	0	0	0	15,675	0	0	0	**15,675**
x5.y13	0	0	0	0	0	0	0	0	15,300	375	0	0	**15,675**
x6.y1	0	0	0	0	0	0	0	0	0	15,675	0	0	**15,675**
x6.y2	0	0	0	0	0	0	0	0	0	15,675	0	0	**15,675**
x6.y3	0	0	0	0	0	0	0	0	10,725	0	0	4,950	**15,675**
x6.y4	0	0	0	0	0	0	0	0	0	15,675	0	0	**15,675**
x6.y5	0	0	0	0	0	0	0	0	0	1,650	0	14,025	**15,675**
x6.y6	0	0	0	0	0	0	0	0	0	15,675	0	0	**15,675**
x6.y7	0	0	0	0	0	0	0	0	0	10,575	5,100	0	**15,675**
x6.y8	0	0	0	0	0	0	0	0	0	15,675	0	0	**15,675**
x6.y9	0	0	0	0	0	0	0	0	15,675	0	0	0	**15,675**
x6.y10	0	0	0	0	0	0	0	0	0	14,400	0	1,275	**15,675**
x6.y11	0	0	0	0	0	0	0	0	0	0	15,675	0	**15,675**
x6.y12	0	0	0	0	0	0	0	0	0	10,575	5,100	0	**15,675**
x6.y13	0	0	0	0	0	0	0	0	0	0	1,950	13,725	**15,675**
x7.y1	0	0	0	0	0	0	0	0	0	0	0	15,675	**15,675**
x7.y2	0	0	0	0	0	0	0	0	0	0	0	15,675	**15,675**
x7.y3	0	0	0	0	0	0	0	0	0	0	0	15,675	**15,675**
x7.y4	0	0	0	0	0	0	0	0	0	0	15,300	375	**15,675**
x7.y5	0	0	0	0	0	0	0	0	0	0	0	15,675	**15,675**
x7.y6	0	0	0	0	0	0	0	0	0	0	1,275	14,400	**15,675**
x7.y7	0	0	0	0	0	0	0	0	0	0	15,675	0	**15,675**
x7.y8	0	0	0	0	0	0	0	0	0	0	15,675	0	**15,675**
x7.y9	0	0	0	0	0	0	0	0	0	0	0	15,675	**15,675**
x7.y10	0	0	0	0	0	0	0	0	0	0	15,300	375	**15,675**
x7.y11	0	0	0	0	0	0	0	0	0	0	15,675	0	**15,675**
x7.y12	0	0	0	0	0	0	0	0	0	0	15,675	0	**15,675**
x7.y13	0	0	0	0	0	0	0	0	10,575	0	5,100	0	**15,675**
TOTAL	**127,200**	**127,500**	**127,500**	**14,000**	**127,500**	**127,500**	**127,500**	**125,972**	**127,500**	**127,500**	**127,500**	**127,500**	**1,414,672**

Table B.4. Western County: Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y2	0	0	126,000	7,000	**133,000**
	x1.y7	0	0	133,000	0	**133,000**
	x2.y13	0	133,000	0	0	**133,000**
	x3.y8	7,000	0	0	7,000	**14,000**
	x3.y13	0	133,000	0	0	**133,000**
	x4.y1	133,000	0	0	0	**133,000**
	x4.y13	0	133,000	0	0	**133,000**
	x5.y13	0	133,000	0	0	**133,000**
	x6.y5	0	0	91,000	42,000	**133,000**
	x6.y7	0	0	0	133,000	**133,000**
	x7.y6	0	0	0	133,000	**133,000**
	x7.y7	0	0	0	133,000	**133,000**
TOTAL		**140,000**	**532,000**	**350,000**	**455,000**	**1,477,000**

Table B.5. Central County: Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION										
		x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x6.y7	x7.y4	x7.y6	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	11	0	0	0	0	0	1	0	0	**12**
	x1.y2	0	0	11	0	0	0	0	0	1	0	0	**12**
	x1.y3	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y4	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y5	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y6	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y7	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y8	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y9	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y10	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y11	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y12	1	0	0	10	0	0	0	0	1	0	0	**12**
	x1.y13	0	0	0	11	0	0	0	0	1	0	0	**12**
	x2.y1	0	0	2	0	0	10	0	0	0	0	0	**12**
	x2.y2	0	0	11	0	0	0	0	0	1	0	0	**12**
	x2.y3	0	1	10	0	0	0	0	0	1	0	0	**12**
	x2.y4	0	11	1	0	0	0	0	0	0	0	0	**12**
	x2.y5	0	11	1	0	0	0	0	0	0	0	0	**12**
	x2.y6	0	12	0	0	0	0	0	0	0	0	0	**12**
	x2.y7	0	12	0	0	0	0	0	0	0	0	0	**12**
	x2.y8	0	12	0	0	0	0	0	0	0	0	0	**12**
	x2.y9	0	11	0	1	0	0	0	0	0	0	0	**12**
	x2.y10	0	11	0	0	0	0	0	0	1	0	0	**12**
	x2.y11	0	2	0	9	0	0	0	0	1	0	0	**12**
	x2.y12	0	0	0	12	0	0	0	0	0	0	0	**12**
	x2.y13	0	0	0	11	0	0	0	0	1	0	0	**12**
	x3.y1	0	0	6	0	6	0	0	0	0	0	0	**12**
	x3.y2	0	0	11	0	0	0	0	0	1	0	0	**12**
	x3.y3	0	0	11	0	0	0	0	0	1	0	0	**12**
	x3.y4	0	0	3	0	8	0	0	0	1	0	0	**12**
	x3.y5	0	0	11	0	0	0	0	0	1	0	0	**12**
	x3.y6	0	5	5	0	0	0	1	0	1	0	0	**12**
	x3.y7	0	11	0	0	0	0	0	0	1	0	0	**12**
	x3.y8	0	7	0	0	0	0	4	0	1	0	0	**12**
	x3.y9	0	0	0	11	0	0	0	0	1	0	0	**12**
	x3.y10	0	0	0	11	0	1	0	0	0	0	0	**12**
	x3.y11	0	0	0	12	0	0	0	0	0	0	0	**12**
	x3.y12	0	0	0	11	0	0	0	0	1	0	0	**12**
	x3.y13	0	0	0	1	0	11	0	0	0	0	0	**12**

Table B.5. (continued)

		LICENSED DEALER LOCATION											
		x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x6.y7	x7.y4	x7.y6	x7.y7	TOTAL
FARM LOCATION	x4.y1	0	0	0	0	12	0	0	0	0	0	0	**12**
	x4.y2	0	0	0	0	12	0	0	0	0	0	0	**12**
	x4.y3	0	0	0	1	11	0	0	0	0	0	0	**12**
	x4.y4	1	0	0	0	11	0	0	0	0	0	0	**12**
	x4.y5	0	0	0	0	11	0	1	0	0	0	0	**12**
	x4.y6	0	0	0	0	0	0	11	0	1	0	0	**12**
	x4.y7	0	0	0	0	0	0	3	0	0	0	0	**3**
	x4.y8	0	0	0	0	0	0	11	0	1	0	0	**12**
	x4.y9	0	0	0	0	0	11	0	0	1	0	0	**12**
	x4.y10	0	0	1	0	0	11	0	0	0	0	0	**12**
	x4.y11	1	0	0	0	0	11	0	0	0	0	0	**12**
	x4.y12	0	0	0	0	0	12	0	0	0	0	0	**12**
	x4.y13	0	0	0	0	0	12	0	0	0	0	0	**12**
	x5.y1	1	0	0	0	11	0	0	0	0	0	0	**12**
	x5.y2	0	0	0	0	11	0	0	0	0	1	0	**12**
	x5.y3	0	0	0	0	10	0	1	1	0	0	0	**12**
	x5.y4	1	0	0	0	0	0	11	0	0	0	0	**12**
	x5.y5	0	0	0	0	0	0	11	0	0	1	0	**12**
	x5.y6	0	0	0	0	0	0	11	0	0	1	0	**12**
	x5.y7	1	0	0	0	0	0	1	10	0	0	0	**12**
	x5.y8	0	0	1	0	0	0	11	0	0	0	0	**12**
	x5.y9	1	0	0	0	0	0	11	0	0	0	0	**12**
	x5.y10	0	0	0	0	0	1	11	0	0	0	0	**12**
	x5.y11	1	0	0	0	0	0	0	11	0	0	0	**12**
	x5.y12	0	0	1	0	0	11	0	0	0	0	0	**12**
	x5.y13	1	0	0	0	0	11	0	0	0	0	0	**12**
	x6.y1	1	0	0	0	0	0	0	10	0	1	0	**12**
	x6.y2	1	0	0	0	0	0	0	0	11	0	0	**12**
	x6.y3	1	0	0	0	0	0	0	0	0	11	0	**12**
	x6.y4	0	0	0	0	0	0	0	1	5	6	0	**12**
	x6.y5	0	0	0	0	0	0	0	0	0	12	0	**12**
	x6.y6	0	0	0	0	0	0	0	1	0	11	0	**12**
	x6.y7	0	0	0	0	0	0	0	0	0	1	11	**12**
	x6.y8	0	0	0	0	0	0	0	12	0	0	0	**12**
	x6.y9	1	0	0	0	0	0	0	11	0	0	0	**12**
	x6.y10	0	0	0	0	0	0	0	11	0	0	1	**12**
	x6.y11	0	0	0	0	0	0	0	11	0	0	1	**12**
	x6.y12	1	0	0	0	0	0	0	11	0	0	0	**12**
	x6.y13	0	0	0	0	0	0	0	11	0	0	1	**12**
	x7.y1	0	0	0	0	0	0	0	0	3	9	0	**12**
	x7.y2	0	0	0	0	0	0	0	0	0	12	0	**12**
	x7.y3	0	0	0	0	0	0	0	0	0	12	0	**12**
	x7.y4	0	0	0	0	0	0	0	0	0	12	0	**12**
	x7.y5	0	0	0	0	0	0	0	0	0	12	0	**12**
	x7.y6	0	0	0	0	0	0	0	0	0	4	8	**12**
	x7.y7	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y8	1	0	0	0	0	0	0	0	0	0	11	**12**
	x7.y9	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y10	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y11	1	0	0	0	0	0	0	0	0	0	11	**12**
	x7.y12	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y13	0	0	1	0	0	0	0	0	0	0	11	**12**
TOTAL		**117**	**106**	**98**	**101**	**103**	**102**	**99**	**101**	**47**	**106**	**103**	**1,083**

Table B.6. Central County: Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	18	0	**18**
	x2.y7	0	0	18	0	**18**
	x3.y1	17	0	0	0	**17**
	x3.y13	0	18	0	0	**18**
	x4.y1	18	0	0	0	**18**
	X4.y13	0	18	0	0	**18**
	x5.y7	0	0	0	18	**18**
	x6.y7	0	0	0	18	**18**
	x7.y4	0	0	0	6	**6**
	x7.y6	0	0	0	18	**18**
	X7.y7	0	0	0	18	**18**
TOTAL		**35**	**36**	**36**	**78**	**185**

Table B.7. Central County: Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION										
		x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x6.y7	x7.y4	x7.y6	x7.y7	TOTAL
FARM LoCATION	x1.y1	0	0	14,025	0	0	0	0	0	283	0	0	**14,308**
	x1.y2	0	0	14,025	0	0	0	0	0	283	0	0	**14,308**
	x1.y3	13,033	0	0	0	0	0	0	0	1,275	0	0	**14,308**
	x1.y4	13,033	0	0	0	0	0	0	0	1,275	0	0	**14,308**
	x1.y5	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y6	13,666	0	0	0	0	0	0	0	642	0	0	**14,308**
	x1.y7	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	13,033	0	0	0	0	0	0	0	1,275	0	0	**14,308**
	x1.y9	13,033	0	0	0	0	0	0	0	1,275	0	0	**14,308**
	x1.y10	14,025	0	0	0	0	0	0	0	283	0	0	**14,308**
	x1.y11	13,033	0	0	0	0	0	0	0	1,275	0	0	**14,308**
	x1.y12	283	0	0	12,750	0	0	0	0	1,275	0	0	**14,308**
	x1.y13	0	0	0	13,683	0	0	0	0	625	0	0	**14,308**
	x2.y1	0	0	1,558	0	0	12,750	0	0	0	0	0	**14,308**
	x2.y2	0	0	14,025	0	0	0	0	0	283	0	0	**14,308**
	x2.y3	0	283	12,750	0	0	0	0	0	1,275	0	0	**14,308**
	x2.y4	0	13,033	1,275	0	0	0	0	0	0	0	0	**14,308**
	x2.y5	0	13,033	1,275	0	0	0	0	0	0	0	0	**14,308**
	x2.y6	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y7	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y8	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y9	0	13,033	0	1,275	0	0	0	0	0	0	0	**14,308**
	x2.y10	0	14,025	0	0	0	0	0	0	283	0	0	**14,308**
	x2.y11	0	2,550	0	11,475	0	0	0	0	283	0	0	**14,308**
	x2.y12	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y13	0	0	0	14,025	0	0	0	0	283	0	0	**14,308**
	x3.y1	0	0	6,658	0	7,650	0	0	0	0	0	0	**14,308**
	x3.y2	0	0	14,025	0	0	0	0	0	283	0	0	**14,308**
	x3.y3	0	0	14,025	0	0	0	0	0	283	0	0	**14,308**
	x3.y4	0	0	3,825	0	9,208	0	0	0	1,275	0	0	**14,308**
	x3.y5	0	0	14,025	0	0	0	0	0	283	0	0	**14,308**
	x3.y6	0	5,383	6,375	0	0	0	1,275	0	1,275	0	0	**14,308**
	x3.y7	0	13,803	0	0	0	0	0	0	505	0	0	**14,308**
	x3.y8	0	7,933	0	0	0	0	5,100	0	1,275	0	0	**14,308**
	x3.y9	0	0	0	14,025	0	0	0	0	283	0	0	**14,308**
	x3.y10	0	0	0	13,113	0	1,195	0	0	0	0	0	**14,308**
	x3.y11	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y12	0	0	0	14,025	0	0	0	0	283	0	0	**14,308**
	x3.y13	0	0	0	1,275	0	13,033	0	0	0	0	0	**14,308**

Table B.7. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x6.y7	x7.y4	x7.y6	x7.y7	TOTAL
x4.y1	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x4.y2	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x4.y3	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
x4.y4	283	0	0	0	14,025	0	0	0	0	0	0	**14,308**
x4.y5	0	0	0	0	13,033	0	1,275	0	0	0	0	**14,308**
x4.y6	0	0	0	0	0	0	14,025	0	283	0	0	**14,308**
x4.y7	0	0	0	0	0	0	3,580	0	0	0	0	**3,580**
x4.y8	0	0	0	0	0	0	14,025	0	283	0	0	**14,308**
x4.y9	0	0	0	0	0	14,025	0	0	283	0	0	**14,308**
x4.y10	0	0	285	0	0	14,023	0	0	0	0	0	**14,308**
x4.y11	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x4.y12	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x4.y13	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x5.y1	283	0	0	0	14,025	0	0	0	0	0	0	**14,308**
x5.y2	0	0	0	0	13,033	0	0	0	0	1,275	0	**14,308**
x5.y3	0	0	0	0	12,750	0	1,275	283	0	0	0	**14,308**
x5.y4	283	0	0	0	0	0	14,025	0	0	0	0	**14,308**
x5.y5	0	0	0	0	0	0	14,025	0	0	283	0	**14,308**
x5.y6	0	0	0	0	0	0	14,025	0	0	283	0	**14,308**
x5.y7	283	0	0	0	0	0	1,275	12,750	0	0	0	**14,308**
x5.y8	0	0	283	0	0	0	14,025	0	0	0	0	**14,308**
x5.y9	283	0	0	0	0	0	14,025	0	0	0	0	**14,308**
x5.y10	0	0	0	0	0	283	14,025	0	0	0	0	**14,308**
x5.y11	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x5.y12	0	0	283	0	0	14,025	0	0	0	0	0	**14,308**
x5.y13	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x6.y1	283	0	0	0	0	0	0	12,750	0	1,275	0	**14,308**
x6.y2	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x6.y3	283	0	0	0	0	0	0	0	0	14,025	0	**14,308**
x6.y4	0	0	0	0	0	0	0	1,275	5,383	7,650	0	**14,308**
x6.y5	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y6	0	0	0	0	0	0	0	1,275	0	13,033	0	**14,308**
x6.y7	0	0	0	0	0	0	0	0	0	283	14,025	**14,308**
x6.y8	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x6.y9	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x6.y10	0	0	0	0	0	0	0	14,025	0	0	283	**14,308**
x6.y11	0	0	0	0	0	0	0	13,033	0	0	1,275	**14,308**
x6.y12	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x6.y13	0	0	0	0	0	0	0	13,398	0	0	910	**14,308**
x7.y1	0	0	0	0	0	0	0	0	3,825	10,483	0	**14,308**
x7.y2	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y3	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y4	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y5	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y6	0	0	0	0	0	0	0	0	0	4.108	10,200	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y8	283	0	0	0	0	0	0	0	0	0	14,025	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y10	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y11	283	0	0	0	0	0	0	0	0	0	14,025	**14,308**
x7.y12	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y13	0	0	283	0	0	0	0	0	0	0	14,025	**14,308**
TOTAL	**126,000**	**126,000**	**119,000**	**125,537**	**125,373**	**126,000**	**125,980**	**125,172**	**42,000**	**124,238**	**126,000**	**1,291,300**

Table B.8. Central County: Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	126,000	0	**126,000**
	x2.y7	0	0	126,000	0	**126,000**
	x3.y1	119,000	0	0	0	**119,000**
	x3.y13	0	126,000	0	0	**126,000**
	x4.y1	126,000	0	0	0	**126,000**
	X4.y13	0	126,000	0	0	**126,000**
	x5.y7	0	0	0	126,000	**126,000**
	x6.y7	0	0	0	126,000	**126,000**
	x7.y4	0	0	0	42,000	**42,000**
	x7.y6	0	0	0	126,000	**126,000**
	X7.y7	0	0	0	126,000	**126,000**
TOTAL		**245,000**	**252,000**	**252,000**	**546,000**	**1,295,000**

Table B.9. Eastern County: Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION														
		x1.y7	x2.y7	x2.y13	x3.y1	x3.y7	x4.y1	x4.y13	x5.y1	x5.y7	x6.y7	x7.y1	x7.y3	x7.y6	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	14	0	1	0	0	0	0	0	0	0	0	**15**
	x1.y2	0	0	0	14	0	0	1	0	0	0	0	0	0	0	**15**
	x1.y3	0	0	1	14	0	0	0	0	0	0	0	0	0	0	**15**
	x1.y4	12	2	1	0	0	0	0	0	0	0	0	0	0	0	**15**
	x1.y5	14	0	0	0	0	0	1	0	0	0	0	0	0	0	**15**
	x1.y6	14	0	0	0	0	0	0	0	0	0	1	0	0	0	**15**
	x1.y7	14	1	0	0	0	0	0	0	0	0	0	0	0	0	**15**
	x1.y8	15	0	0	0	0	0	0	0	0	0	0	0	0	0	**15**
	x1.y9	9	0	0	0	0	0	0	0	6	0	0	0	0	0	**15**
	x1.y10	14	0	1	0	0	0	0	0	0	0	0	0	0	0	**15**
	x1.y11	7	0	8	0	0	0	0	0	0	0	0	0	0	0	**15**
	x1.y12	0	0	14	0	0	0	0	0	0	0	0	1	0	0	**15**
	x1.y13	0	0	14	0	0	0	0	0	0	0	1	0	0	0	**15**
	x2.y1	0	0	0	14	0	1	0	0	0	0	0	0	0	0	**15**
	x2.y2	0	0	1	13	0	1	0	0	0	0	0	0	0	0	**15**
	x2.y3	0	0	1	14	0	0	0	0	0	0	0	0	0	0	**15**
	x2.y4	0	14	0	0	0	0	1	0	0	0	0	0	0	0	**15**
	x2.y5	0	14	0	0	0	0	1	0	0	0	0	0	0	0	**15**
	x2.y6	0	14	0	0	0	0	0	0	0	0	0	1	0	0	**15**
	x2.y7	0	15	0	0	0	0	0	0	0	0	0	0	0	0	**15**
	x2.y8	0	15	0	0	0	0	0	0	0	0	0	0	0	0	**15**
	x2.y9	1	14	0	0	0	0	0	0	0	0	0	0	0	0	**15**
	x2.y10	0	13	0	0	0	0	0	0	0	2	0	0	0	0	**15**
	x2.y11	0	0	15	0	0	0	0	0	0	0	0	0	0	0	**15**
	x2.y12	0	0	15	0	0	0	0	0	0	0	0	0	0	0	**15**
	x2.y13	0	0	15	0	0	0	0	0	0	0	0	0	0	0	**15**
	x3.y1	0	0	0	3	0	12	0	0	0	0	0	0	0	0	**15**
	x3.y2	0	0	0	1	0	14	0	0	0	0	0	0	0	0	**15**
	x3.y3	0	0	1	11	0	3	0	0	0	0	0	0	0	0	**15**
	x3.y4	0	0	1	2	0	12	0	0	0	0	0	0	0	0	**15**
	x3.y5	0	0	1	0	14	0	0	0	0	0	0	0	0	0	**15**
	x3.y6	0	0	0	0	15	0	0	0	0	0	0	0	0	0	**15**
	x3.y7	0	0	0	0	14	0	0	0	1	0	0	0	0	0	**15**
	x3.y8	0	0	0	0	15	0	0	0	0	0	0	0	0	0	**15**
	x3.y9	0	0	0	0	14	0	0	0	0	0	1	0	0	0	**15**
	x3.y10	1	0	0	0	14	0	0	0	0	0	0	0	0	0	**15**
	x3.y11	0	0	1	0	14	0	0	0	0	0	0	0	0	0	**15**
	x3.y12	0	0	10	0	0	0	4	0	0	0	1	0	0	0	**15**
	x3.y13	1	0	0	0	0	0	14	0	0	0	0	0	0	0	**15**
	x4.y1	0	0	1	0	0	0	0	14	0	0	0	0	0	0	**15**
	x4.y2	0	0	0	0	0	15	0	0	0	0	0	0	0	0	**15**
	x4.y3	0	0	1	0	0	14	0	0	0	0	0	0	0	0	**15**
	x4.y4	0	0	0	0	0	14	0	1	0	0	0	0	0	0	**15**
	x4.y5	0	0	0	0	0	11	0	4	0	0	0	0	0	0	**15**
	x4.y6	0	0	1	0	0	0	0	0	14	0	0	0	0	0	**15**
	x4.y7	0	0	0	0	0	0	0	0	4	0	0	0	0	0	**4**
	x4.y8	0	0	0	0	0	0	0	0	15	0	0	0	0	0	**15**
	x4.y9	0	0	1	0	0	0	0	0	14	0	0	0	0	0	**15**
	x4.y10	1	0	0	0	0	0	13	0	1	0	0	0	0	0	**15**
	x4.y11	1	0	0	0	0	0	14	0	0	0	0	0	0	0	**15**
	x4.y12	0	0	0	0	0	0	15	0	0	0	0	0	0	0	**15**
	x4.y13	0	0	0	0	0	0	15	0	0	0	0	0	0	0	**15**
	x5.y1	0	0	1	0	0	0	0	14	0	0	0	0	0	0	**15**

Table B.9. (continued)

	LICENSED DEALER LOCATION														
	x1.y7	x2.y7	x2.y13	x3.y1	x3.y7	x4.y1	x4.y13	x5.y1	x5.y7	x6.y7	x7.y1	x7.y3	x7.y6	x7.y7	TOTAL
x5.y2	0	0	0	0	0	0	0	15	0	0	0	0	0	0	**15**
x5.y3	0	0	1	0	0	0	0	0	0	0	0	14	0	0	**15**
x5.y4	0	0	1	0	0	0	0	12	0	0	0	2	0	0	**15**
x5.y5	0	0	0	0	0	0	0	0	6	0	0	9	0	0	**15**
x5.y6	0	0	0	0	0	0	0	12	1	0	0	0	2	0	**15**
x5.y7	0	0	1	0	0	0	0	0	2	12	0	0	0	0	**15**
x5.y8	0	0	0	1	0	0	0	0	11	3	0	0	0	0	**15**
x5.y9	0	0	0	0	1	0	2	0	13	0	0	0	0	0	**16**
x5.y10	0	0	0	0	0	0	0	0	0	15	0	0	0	0	**15**
x5.y11	0	0	1	0	0	0	0	0	14	0	0	0	0	0	**15**
x5.y12	0	0	0	0	0	0	8	0	0	7	0	0	0	0	**15**
x5.y13	1	0	0	0	0	0	14	0	0	0	0	0	0	0	**15**
x6.y1	0	0	0	0	0	0	0	1	0	0	14	0	0	0	**15**
x6.y2	0	0	1	0	0	0	0	0	0	0	14	0	0	0	**15**
x6.y3	0	0	0	0	0	0	0	0	0	0	1	14	0	0	**15**
x6.y4	0	0	0	0	0	1	0	0	0	1	12	1	0	0	**15**
x6.y5	0	0	1	0	0	0	0	0	0	0	0	14	0	0	**15**
x6.y6	0	0	0	0	0	0	0	0	0	0	0	1	14	0	**15**
x6.y7	0	0	1	0	0	0	0	0	0	13	0	0	0	1	**15**
x6.y8	0	0	0	0	0	0	0	0	0	14	0	0	0	1	**15**
x6.y9	0	0	0	0	0	0	0	0	0	0	0	0	1	14	**15**
x6.y10	0	0	0	0	0	0	0	0	0	14	0	0	1	0	**15**
x6.y11	0	0	0	0	0	0	0	0	0	13	0	1	1	0	**15**
x6.y12	0	0	0	0	0	0	0	0	0	0	0	0	3	12	**15**
x6.y13	0	0	0	0	0	0	0	0	0	7	0	0	4	4	**15**
x7.y1	0	0	0	0	0	0	0	0	0	0	14	0	0	1	**15**
x7.y2	0	0	0	0	0	0	0	0	0	0	14	0	0	1	**15**
x7.y3	0	0	0	0	0	0	0	0	0	0	14	0	1	0	**15**
x7.y4	0	0	0	0	0	0	0	0	0	0	14	0	1	0	**15**
x7.y5	0	0	0	0	0	0	0	0	0	0	0	14	1	0	**15**
x7.y6	0	0	1	0	0	0	0	0	0	0	0	14	0	0	**15**
x7.y7	0	0	1	0	0	0	0	0	0	0	0	14	0	0	**15**
x7.y8	0	0	0	0	0	0	0	0	0	0	0	0	2	13	**15**
x7.y9	1	0	0	0	0	0	0	0	0	0	0	0	0	14	**15**
x7.y10	0	0	0	0	0	0	0	0	0	0	0	0	1	14	**15**
x7.y11	0	0	0	0	0	0	0	0	0	0	0	0	0	15	**15**
x7.y12	0	0	0	0	0	0	0	0	0	0	0	0	14	1	**15**
x7.y13	1	0	0	0	0	0	0	0	0	0	0	0	3	11	**15**
TOTAL	**107**	**102**	**114**	**101**	**101**	**99**	**103**	**73**	**102**	**101**	**101**	**100**	**49**	**102**	**1,355**

Table B.10. Eastern County: Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	18	0	**18**
	x2.y7	0	0	18	0	**18**
	x2.y13	0	18	0	0	**18**
	x3.y1	18	0	0	0	**18**
	x3.y7	0	0	18	0	**18**
	X4.y1	18	0	0	0	**18**
	x4.y13	0	19	0	0	**19**
	x5.y1	13	0	0	0	**13**
	x5.y7	0	0	0	18	**18**
	x6.y7	0	0	0	19	**19**
	x7.y1	18	1	0	0	**19**
	x7.y3	0	1	0	18	**19**
	x7.y6	0	0	0	8	**8**
	x7.y7	0	0	0	18	**18**
TOTAL		**67**	**39**	**54**	**81**	**241**

Table B.11. Eastern County: Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

	LICENSED DEALER LOCATION														
FARM LOCATION	x1.y7	x2.y7	x2.y13	x3.y1	x3.y7	x4.y1	x4.y13	x5.y1	x5.y7	x6.y7	x7.y1	x7.y3	x7.y6	x7.y7	TOTAL
x1.y1	0	0	0	17,168	0	1,275	0	0	0	0	0	0	0	0	18,443
x1.y2	0	0	0	17,850	0	0	593	0	0	0	0	0	0	0	18,443
x1.y3	0	0	593	17,850	0	0	0	0	0	0	0	0	0	0	18,443
x1.y4	15,300	2,550	593	0	0	0	0	0	0	0	0	0	0	0	18,443
x1.y5	17,168	0	0	0	0	0	1,275	0	0	0	0	0	0	0	18,443
x1.y6	17,168	0	0	0	0	0	0	0	0	0	1,275	0	0	0	18,443
x1.y7	17,168	1,275	0	0	0	0	0	0	0	0	0	0	0	0	18,443
x1.y8	18,443	0	0	0	0	0	0	0	0	0	0	0	0	0	18,443
x1.y9	10,793	0	0	0	0	0	0	0	7,650	0	0	0	0	0	18,443
x1.y10	17,168	0	1,275	0	0	0	0	0	0	0	0	0	0	0	18,443
x1.y11	8,641	0	9,802	0	0	0	0	0	0	0	0	0	0	0	18,443
x1.y12	0	0	17,168	0	0	0	0	0	0	0	0	1,275	0	0	18,443
x1.y13	0	0	17,168	0	0	0	0	0	0	0	1,275	0	0	0	18,443
x2.y1	0	0	0	17,168	0	1,275	0	0	0	0	0	0	0	0	18,443
x2.y2	0	0	593	16,575	0	1,275	0	0	0	0	0	0	0	0	18,443
x2.y3	0	0	593	17,850	0	0	0	0	0	0	0	0	0	0	18,443
x2.y4	0	17,168	0	0	0	0	1,275	0	0	0	0	0	0	0	18,443
x2.y5	0	17,824	0	0	0	0	619	0	0	0	0	0	0	0	18,443
x2.y6	0	17,168	0	0	0	0	0	0	0	0	0	1,275	0	0	18,443
x2.y7	0	18,443	0	0	0	0	0	0	0	0	0	0	0	0	18,443
x2.y8	0	18,443	0	0	0	0	0	0	0	0	0	0	0	0	18,443
x2.y9	0	17,168	0	0	0	0	0	0	0	0	1,275	0	0	0	18,443
x2.y10	0	15,893	0	0	0	0	0	0	0	2,550	0	0	0	0	18,443
x2.y11	0	0	18,443	0	0	0	0	0	0	0	0	0	0	0	18,443
x2.y12	0	0	18,443	0	0	0	0	0	0	0	0	0	0	0	18,443
x2.y13	0	0	18,443	0	0	0	0	0	0	0	0	0	0	0	18,443
x3.y1	0	0	0	3,143	0	15,300	0	0	0	0	0	0	0	0	18,443
x3.y2	0	0	0	593	0	17,850	0	0	0	0	0	0	0	0	18,443
x3.y3	0	0	593	14,025	0	3,825	0	0	0	0	0	0	0	0	18,443
x3.y4	0	0	640	2,503	0	15,300	0	0	0	0	0	0	0	0	18,443
x3.y5	0	0	593	0	17,850	0	0	0	0	0	0	0	0	0	18,443
x3.y6	0	0	0	0	18,443	0	0	0	0	0	0	0	0	0	18,443
x3.y7	0	0	0	0	17,850	0	0	0	593	0	0	0	0	0	18,443
x3.y8	0	0	0	0	18,443	0	0	0	0	0	0	0	0	0	18,443
x3.y9	0	0	0	0	17,168	0	0	0	0	0	1,275	0	0	0	18,443
x3.y10	593	0	0	0	17,850	0	0	0	0	0	0	0	0	0	18,443
x3.y11	0	0	593	0	17,850	0	0	0	0	0	0	0	0	0	18,443
x3.y12	0	0	12,068	0	0	0	5,100	0	0	0	1,275	0	0	0	18,443
x3.y13	593	0	0	0	0	0	17,850	0	0	0	0	0	0	0	18,443
x4.y1	0	0	593	0	0	0	0	17,850	0	0	0	0	0	0	18,443
x4.y2	0	0	0	0	0	18,443	0	0	0	0	0	0	0	0	18,443
x4.y3	0	0	593	0	0	17,850	0	0	0	0	0	0	0	0	18,443
x4.y4	0	0	0	0	0	17,850	0	593	0	0	0	0	0	0	18,443
x4.y5	0	0	0	0	0	14,025	0	4,418	0	0	0	0	0	0	18,443
x4.y6	0	0	593	0	0	0	0	0	17,850	0	0	0	0	0	18,443
x4.y7	0	0	0	0	0	0	0	0	4,605	0	0	0	0	0	4,605
x4.y8	0	0	0	0	0	0	0	0	18,443	0	0	0	0	0	18,443
x4.y9	0	0	633	0	0	0	0	0	17,810	0	0	0	0	0	18,443
x4.y10	593	0	0	0	0	0	16,575	0	1,275	0	0	0	0	0	18,443
x4.y11	593	0	0	0	0	0	17,850	0	0	0	0	0	0	0	18,443
x4.y12	0	0	0	0	0	0	18,443	0	0	0	0	0	0	0	18,443
x4.y13	0	0	0	0	0	0	18,443	0	0	0	0	0	0	0	18,443
x5.y1	0	0	593	0	0	0	0	17,850	0	0	0	0	0	0	18,443
x5.y2	0	0	0	0	0	0	0	18,443	0	0	0	0	0	0	18,443
x5.y3	0	0	593	0	0	0	0	0	0	0	0	17,850	0	0	18,443
x5.y4	0	0	622	0	0	0	0	15,271	0	0	0	2,550	0	0	18,443
x5.y5	0	0	0	0	0	0	0	0	6,968	0	0	11,475	0	0	18,443
x5.y6	0	0	0	0	0	0	0	15,300	1,275	0	0	0	1,868	0	18,443
x5.y7	0	0	593	0	0	0	0	0	2,550	15,300	0	0	0	0	18,443
x5.y8	0	0	0	1,275	0	0	0	0	13,343	3,825	0	0	0	0	18,443
x5.y9	0	0	0	0	546	0	2,109	0	15,788	0	0	0	0	0	18,443
x5.y10	0	0	0	0	0	0	0	0	0	18,443	0	0	0	0	18,443
x5.y11	0	0	593	0	0	0	0	0	17,850	0	0	0	0	0	18,443
x5.y12	0	0	0	0	0	0	9,518	0	0	8,925	0	0	0	0	18,443
x5.y13	593	0	0	0	0	0	17,850	0	0	0	0	0	0	0	18,443
x6.y1	0	0	0	0	0	0	0	1,275	0	0	17,168	0	0	0	18,443
x6.y2	0	0	593	0	0	0	0	0	0	0	17,850	0	0	0	18,443
x6.y3	0	0	0	0	0	0	0	0	0	0	593	17,850	0	0	18,443
x6.y4	0	0	0	0	0	1,275	0	0	0	1,275	14,618	1,275	0	0	18,443
x6.y5	0	0	593	0	0	0	0	0	0	0	0	17,850	0	0	18,443
x6.y6	0	0	0	0	0	0	0	0	0	0	0	1,275	17,168	0	18,443
x6.y7	0	0	621	0	0	0	0	0	0	16,575	0	0	0	1,247	18,443
x6.y8	0	0	0	0	0	0	0	0	0	17,257	0	0	0	1,186	18,443
x6.y9	0	0	0	0	0	0	0	0	0	0	0	0	593	17,850	18,443
x6.y10	0	0	0	0	0	0	0	0	0	17,850	0	0	593	0	18,443
x6.y11	0	0	0	0	0	0	0	0	0	16,575	0	1,275	593	0	18,443
x6.y12	0	0	0	0	0	0	0	0	0	0	0	0	3,825	14,618	18,443
x6.y13	0	0	0	0	0	0	0	0	0	8,925	0	0	5,100	4,418	18,443
x7.y1	0	0	0	0	0	0	0	0	0	0	17,850	0	0	593	18,443
x7.y2	0	0	0	0	0	0	0	0	0	0	17,850	0	0	593	18,443
x7.y3	0	0	0	0	0	0	0	0	0	0	17,850	0	0	593	18,443
x7.y4	0	0	0	0	0	0	0	0	0	0	17,346	0	1,097	0	18,443
x7.y5	0	0	0	0	0	0	0	0	0	0	0	17,850	593	0	18,443
x7.y6	0	0	593	0	0	0	0	0	0	0	0	17,850	0	0	18,443
x7.y7	0	0	593	0	0	0	0	0	0	0	0	17,850	0	0	18,443
x7.y8	0	0	0	0	0	0	0	0	0	0	0	0	1,868	16,575	18,443
x7.y9	593	0	0	0	0	0	0	0	0	0	0	0	0	17,850	18,443
x7.y10	0	0	0	0	0	0	0	0	0	0	0	0	593	17,850	18,443
x7.y11	0	0	0	0	0	0	0	0	0	0	0	0	0	18,443	18,443
x7.y12	0	0	0	0	0	0	0	0	0	0	0	0	17,691	752	18,443
x7.y13	593	0	0	0	0	0	0	0	0	0	0	0	3,825	14,025	18,443
TOTAL	126,000	125,932	126,000	126,000	126,000	125,543	127,500	91,000	126,000	127,500	127,500	127,500	55,407	126,593	1,664,475

Table B.12. Eastern County: Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

	MANUFACTURER LOCATION				
LICENSED DEALER LOCATION	m1	m2	m3	m4	TOTAL
X1.y7	0	0	126,000	0	**126,000**
x2.y7	0	0	126,000	0	**126,000**
x2.y13	0	126,000	0	0	**126,000**
x3.y1	126,000	0	0	0	**126,000**
x3.y7	0	0	126,000	0	**126,000**
X4.y1	126,000	0	0	0	**126,000**
x4.y13	0	133,000	0	0	**133,000**
x5.y1	91,000	0	0	0	**91,000**
x5.y7	0	0	0	126,000	**126,000**
x6.y7	0	0	0	133,000	**133,000**
x7.y1	126,000	7,000	0	0	**133,000**
x7.y3	0	7,000	0	126,000	**133,000**
x7.y6	0	0	0	56,000	**56,000**
x7.y7	0	0	0	126,000	**126,000**
TOTAL	**469,000**	**273,000**	**378,000**	**567,000**	**1,687,000**

Table B.13. Central County: Increased Fixed Costs - Number of Trips from Farm to Licensed Dealer

	LICENSED DEALER LOCATION											
FARM LOCATION	x1.y7	x2.y7	x2.y9	x3.y1	x3.y13	x4.y1	x4.y12	x4.y13	x6.y7	x7.y7	x7.y8	TOTAL
x1.y1	1	0	0	10	0	0	0	0	0	0	1	**12**
x1.y2	10	0	0	1	0	0	0	0	0	0	1	**12**
x1.y3	11	0	0	0	0	0	0	0	0	0	1	**12**
x1.y4	11	0	0	0	0	0	0	0	0	0	1	**12**
x1.y5	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y6	11	0	0	0	0	0	0	0	0	0	1	**12**
x1.y7	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y8	11	0	0	0	0	0	0	0	0	1	0	**12**
x1.y9	0	0	11	0	0	0	0	0	0	1	0	**12**
x1.y10	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y11	10	0	0	0	1	0	0	0	0	0	1	**12**
x1.y12	0	0	0	0	11	0	0	0	0	1	0	**12**
x1.y13	0	0	0	0	11	0	0	0	0	0	1	**12**
x2.y1	0	0	0	11	0	0	0	0	0	0	1	**12**
x2.y2	0	0	0	11	0	0	0	0	0	0	1	**12**
x2.y3	0	0	0	11	0	0	0	0	0	0	1	**12**
x2.y4	0	11	0	0	0	0	0	0	0	0	1	**12**
x2.y5	0	11	0	0	0	0	0	0	0	0	1	**12**
x2.y6	0	11	0	0	0	0	0	0	0	0	1	**12**
x2.y7	0	12	0	0	0	0	0	0	0	0	0	**12**
x2.y8	0	7	5	0	0	0	0	0	0	0	0	**12**
x2.y9	1	10	0	0	0	0	0	0	0	1	0	**12**
x2.y10	0	4	0	0	7	0	0	0	0	1	0	**12**
x2.y11	0	0	0	0	11	0	0	0	0	1	0	**12**
x2.y12	0	0	0	0	11	0	0	0	0	0	1	**12**
x2.y13	0	0	0	0	11	1	0	0	0	0	0	**12**
x3.y1	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y2	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y3	0	0	0	11	0	0	0	0	0	0	1	**12**
x3.y4	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y5	0	2	0	9	1	0	0	0	0	0	0	**12**
x3.y6	0	11	0	0	0	0	0	0	0	0	1	**12**
x3.y7	0	11	0	0	0	0	0	0	0	0	1	**12**
x3.y8	0	11	0	0	0	0	0	0	0	1	0	**12**
x3.y9	0	0	0	0	9	0	3	0	0	0	0	**12**
x3.y10	0	0	0	0	11	0	0	1	0	0	0	**12**

Table B.13. (continued)

LICENSED DEALER LOCATION												
	x1.y7	x2.y7	x2.y9	x3.y1	x3.y13	x4.y1	x4.y12	x4.y13	x6.y7	x7.y7	x7.y8	TOTAL
x3.y11	0	0	0	0	12	0	0	0	0	0	0	12
x3.y12	0	0	0	0	3	0	3	6	0	0	0	12
x3.y13	0	0	0	0	1	0	0	11	0	0	0	12
x4.y1	0	0	1	2	0	9	0	0	0	0	0	12
x4.y2	0	0	0	1	0	10	0	0	0	0	1	12
x4.y3	0	0	0	1	0	11	0	0	0	0	0	12
x4.y4	0	0	0	0	0	11	0	0	0	0	1	12
x4.y5	0	0	0	0	0	8	0	3	0	0	1	12
x4.y6	0	1	0	0	0	0	11	0	0	0	0	12
x4.y7	0	3	0	0	0	0	0	0	0	0	0	3
x4.y8	0	0	0	0	0	0	10	2	0	0	0	12
x4.y9	0	0	1	0	0	0	1	10	0	0	0	12
x4.y10	0	0	0	1	0	0	11	0	0	0	0	12
x4.y11	0	0	0	0	0	0	11	1	0	0	0	12
x4.y12	0	0	0	0	0	0	1	11	0	0	0	12
x4.y13	0	0	0	0	0	0	0	12	0	0	0	12
x5.y1	0	0	1	0	0	11	0	0	0	0	0	12
x5.y2	1	0	0	0	0	11	0	0	0	0	0	12
x5.y3	1	0	0	0	0	11	0	0	0	0	0	12
x5.y4	0	0	0	0	0	3	0	0	9	0	0	12
x5.y5	0	0	1	0	0	0	0	0	11	0	0	12
x5.y6	1	0	0	0	0	0	0	0	11	0	0	12
x5.y7	0	0	0	0	0	0	0	0	11	0	1	12
x5.y8	0	0	0	0	0	0	7	0	4	1	0	12
x5.y9	0	0	0	0	0	0	11	1	0	0	0	12
x5.y10	0	0	0	1	0	0	11	0	0	0	0	12
x5.y11	0	0	0	1	0	0	11	0	0	0	0	12
x5.y12	0	0	0	1	0	0	1	10	0	0	0	12
x5.y13	0	0	0	1	0	0	0	11	0	0	0	12
x6.y1	1	0	0	0	0	6	0	0	5	0	0	12
x6.y2	0	0	0	0	0	1	0	0	11	0	0	12
x6.y3	0	0	0	0	0	0	0	0	11	1	0	12
x6.y4	0	0	0	0	0	0	0	0	5	7	0	12
x6.y5	1	0	0	0	0	0	0	0	11	0	0	12
x6.y6	0	0	1	0	0	0	0	0	11	0	0	12
x6.y7	0	0	1	0	0	0	0	0	0	11	0	12
x6.y8	0	0	0	0	0	0	0	0	0	1	11	12
x6.y9	0	0	0	0	0	0	0	0	6	0	6	12
x6.y10	0	0	0	0	0	0	0	2	0	0	10	12
x6.y11	0	0	0	1	0	0	0	11	0	0	0	12
x6.y12	0	0	0	1	0	0	11	0	0	0	0	12
x6.y13	0	0	0	1	0	0	0	11	0	0	0	12
x7.y1	0	0	1	0	0	11	0	0	0	0	0	12
x7.y2	0	0	1	0	0	0	0	0	0	11	0	12
x7.y3	0	0	0	0	0	0	0	0	0	12	0	12
x7.y4	0	0	0	0	0	0	0	0	0	12	0	12
x7.y5	0	0	1	0	0	0	0	0	0	11	0	12
x7.y6	1	0	0	0	0	0	0	0	0	11	0	12
x7.y7	0	0	0	0	0	0	0	0	0	12	0	12
x7.y8	0	0	0	0	0	0	0	0	0	9	3	12
x7.y9	0	0	0	0	0	0	0	0	0	0	12	12
x7.y10	0	0	0	0	0	0	0	0	0	0	12	12
x7.y11	0	0	0	0	0	0	0	0	0	0	12	12
x7.y12	0	0	0	0	0	0	0	1	0	0	11	12
x7.y13	0	0	0	0	0	0	0	1	0	1	10	12
TOTAL	108	105	25	112	100	104	103	105	106	107	108	1,083

Table B.14. Central County: Increased Fixed Costs - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	19	0	**19**
	x2.y7	0	0	19	0	**19**
	x2.y9	0	0	3	0	**3**
	x3.y1	18	0	0	0	**18**
	x3.y13	0	18	0	0	**18**
	X4.y1	18	1	0	0	**19**
	x4.y12	1	18	0	0	**19**
	x4.y13	1	18	0	0	**19**
	x6.y7	0	0	0	19	**19**
	x7.y7	0	0	1	18	**19**
	X7.y8	0	0	0	18	**18**
TOTAL		**38**	**55**	**42**	**55**	**190**

Table B.15. Central County: Increased Fixed Costs - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION										
		x1.y7	x2.y7	x2.y9	x3.y1	x3.y13	x4.y1	x4.y12	x4.y13	x6.y7	x7.y7	x7.y8	TOTAL
FARM LOCATION	x1.y1	283	0	0	12,750	0	0	0	0	0	0	1,275	**14,308**
	x1.y2	12,750	0	0	283	0	0	0	0	0	0	1,275	**14,308**
	x1.y3	13,033	0	0	0	0	0	0	0	0	0	1,275	**14,308**
	x1.y4	13,033	0	0	0	0	0	0	0	0	0	1,275	**14,308**
	x1.y5	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y6	13,033	0	0	0	0	0	0	0	0	0	1,275	**14,308**
	x1.y7	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	14,025	0	0	0	0	0	0	0	0	283	0	**14,308**
	x1.y9	0	0	13,033	0	0	0	0	0	0	1,275	0	**14,308**
	x1.y10	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y11	12,750	0	0	0	1,275	0	0	0	0	0	283	**14,308**
	x1.y12	0	0	0	0	14,025	0	0	0	0	283	0	**14,308**
	x1.y13	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
	x2.y1	0	0	0	13,033	0	0	0	0	0	0	1,275	**14,308**
	x2.y2	0	0	0	13,033	0	0	0	0	0	0	1,275	**14,308**
	x2.y3	0	0	0	13,033	0	0	0	0	0	0	1,275	**14,308**
	x2.y4	0	14,025	0	0	0	0	0	0	0	0	283	**14,308**
	x2.y5	0	13,033	0	0	0	0	0	0	0	0	1,275	**14,308**
	x2.y6	0	13,033	0	0	0	0	0	0	0	0	1,275	**14,308**
	x2.y7	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y8	0	8,925	5,383	0	0	0	0	0	0	0	0	**14,308**
	x2.y9	283	12,750	0	0	0	0	0	0	0	1,275	0	**14,308**
	x2.y10	0	5,100	0	0	8,925	0	0	0	0	283	0	**14,308**
	x2.y11	0	0	0	0	14,025	0	0	0	0	283	0	**14,308**
	x2.y12	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
	x2.y13	0	0	0	0	14,025	283	0	0	0	0	0	**14,308**
	x3.y1	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y2	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y3	0	0	0	13,033	0	0	0	0	0	0	1,275	**14,308**
	x3.y4	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y5	0	1,558	0	11,475	1,275	0	0	0	0	0	0	**14,308**
	x3.y6	0	14,025	0	0	0	0	0	0	0	0	283	**14,308**
	x3.y7	0	13,847	0	0	0	0	0	0	0	0	461	**14,308**
	x3.y8	0	13,033	0	0	0	0	0	0	0	1,275	0	**14,308**
	x3.y9	0	0	0	0	11,475	0	2,833	0	0	0	0	**14,308**
	x3.y10	0	0	0	0	13,517	0	0	791	0	0	0	**14,308**
	x3.y11	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y12	0	0	0	0	3,825	0	3,825	6,658	0	0	0	**14,308**
	x3.y13	0	0	0	0	1,275	0	0	13,033	0	0	0	**14,308**
	x4.y1	0	0	283	2,550	0	11,475	0	0	0	0	0	**14,308**
	x4.y2	0	0	0	1,275	0	11,758	0	0	0	0	1,275	**14,308**
	x4.y3	0	0	0	283	0	14,025	0	0	0	0	0	**14,308**
	x4.y4	0	0	0	0	0	13,891	0	0	0	0	417	**14,308**
	x4.y5	0	0	0	0	0	9,208	0	3,825	0	0	1,275	**14,308**
	x4.y6	0	283	0	0	0	0	14,025	0	0	0	0	**14,308**
	x4.y7	0	3,580	0	0	0	0	0	0	0	0	0	**3,580**
	x4.y8	0	0	0	0	0	0	11,758	2,550	0	0	0	**14,308**
	x4.y9	0	0	283	0	0	0	1,275	12,750	0	0	0	**14,308**
	x4.y10	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
	x4.y11	0	0	0	0	0	0	13,176	1,132	0	0	0	**14,308**
	x4.y12	0	0	0	0	0	0	1,275	13,033	0	0	0	**14,308**

Table B.15. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y7	x2.y9	x3.y1	x3.y13	x4.y1	x4.y12	x4.y13	x6.y7	x7.y7	x7.y8	TOTAL
x4.y13	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y1	0	0	283	0	0	14,025	0	0	0	0	0	**14,308**
x5.y2	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x5.y3	995	0	0	0	0	13,313	0	0	0	0	0	**14,308**
x5.y4	0	0	0	0	0	2,833	0	0	11,475	0	0	**14,308**
x5.y5	0	0	283	0	0	0	0	0	14,025	0	0	**14,308**
x5.y6	1,275	0	0	0	0	0	0	0	13,033	0	0	**14,308**
x5.y7	0	0	0	0	0	0	0	0	13,033	0	1,275	**14,308**
x5.y8	0	0	0	0	0	0	8,925	0	4,108	1,275	0	**14,308**
x5.y9	0	0	0	0	0	0	13,033	1,275	0	0	0	**14,308**
x5.y10	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x5.y11	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x5.y12	0	0	0	283	0	0	1,275	12,750	0	0	0	**14,308**
x5.y13	0	0	0	283	0	0	0	14,025	0	0	0	**14,308**
x6.y1	283	0	0	0	0	7,650	0	0	6,375	0	0	**14,308**
x6.y2	0	0	0	0	0	989	0	0	13,319	0	0	**14,308**
x6.y3	0	0	0	0	0	0	0	0	13,033	1,275	0	**14,308**
x6.y4	0	0	0	0	0	0	0	0	5,383	8,925	0	**14,308**
x6.y5	1,275	0	0	0	0	0	0	0	13,033	0	0	**14,308**
x6.y6	0	0	283	0	0	0	0	0	14,025	0	0	**14,308**
x6.y7	0	0	283	0	0	0	0	0	0	14,025	0	**14,308**
x6.y8	0	0	0	0	0	0	0	0	0	1,275	13,033	**14,308**
x6.y9	0	0	0	0	0	0	0	0	6,658	0	7,650	**14,308**
x6.y10	0	0	0	0	0	0	0	1,762	0	0	12,546	**14,308**
x6.y11	0	0	0	283	0	0	0	14,025	0	0	0	**14,308**
x6.y12	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x6.y13	0	0	0	283	0	0	0	14,025	0	0	0	**14,308**
x7.y1	0	0	283	0	0	14,025	0	0	0	0	0	**14,308**
x7.y2	0	0	283	0	0	0	0	0	0	14,025	0	**14,308**
x7.y3	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y4	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y5	0	0	320	0	0	0	0	0	0	13,988	0	**14,308**
x7.y6	1,275	0	0	0	0	0	0	0	0	13,033	0	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y8	0	0	0	0	0	0	0	0	0	11,379	2,929	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y10	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y11	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y12	0	0	0	0	0	0	0	283	0	0	14,025	**14,308**
x7.y13	0	0	0	0	0	0	0	1,275	0	283	12,750	**14,308**
TOTAL	**127,500**	**127,500**	**21,000**	**125,936**	**126,000**	**127,500**	**127,500**	**127,500**	**127,500**	**127,364**	**126,000**	**1,291,300**

Table B.16. Central County: Increased Fixed Costs - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	133,000	0	**133,000**
	x2.y7	0	0	133,000	0	**133,000**
	x2.y9	0	0	21,000	0	**21,000**
	x3.y1	126,000	0	0	0	**126,000**
	x3.y13	0	126,000	0	0	**126,000**
	X4.y1	126,000	7,000	0	0	**133,000**
	x4.y12	7,000	126,000	0	0	**133,000**
	x4.y13	7,000	126,000	0	0	**133,000**
	x6.y7	0	0	0	133,000	**133,000**
	x7.y7	0	0	7,000	126,000	**133,000**
	X7.y8	0	0	0	126,000	**126,000**
TOTAL		**266,000**	**385,000**	**294,000**	**385,000**	**1,330,000**

Table B.17. Central County: Decreased Fixed Costs - Number of Trips from Farm to Licensed Dealer

	LICENSED DEALER LOCATION											
FARM LOCATION	x1.y7	x2.y6	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
x1.y1	1	0	0	11	0	0	0	0	0	0	0	**12**
x1.y2	0	1	0	11	0	0	0	0	0	0	0	**12**
x1.y3	9	1	2	0	0	0	0	0	0	0	0	**12**
x1.y4	11	0	1	0	0	0	0	0	0	0	0	**12**
x1.y5	11	0	1	0	0	0	0	0	0	0	0	**12**
x1.y6	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y7	5	0	7	0	0	0	0	0	0	0	0	**12**
x1.y8	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y9	11	0	1	0	0	0	0	0	0	0	0	**12**
x1.y10	11	0	0	0	0	0	0	0	0	0	1	**12**
x1.y11	11	0	0	0	0	0	0	0	0	0	1	**12**
x1.y12	0	0	0	0	11	0	0	0	0	0	1	**12**
x1.y13	0	0	0	0	11	0	0	0	0	0	1	**12**
x2.y1	0	1	0	11	0	0	0	0	0	0	0	**12**
x2.y2	0	1	0	11	0	0	0	0	0	0	0	**12**
x2.y3	0	2	0	10	0	0	0	0	0	0	0	**12**
x2.y4	0	12	0	0	0	0	0	0	0	0	0	**12**
x2.y5	0	12	0	0	0	0	0	0	0	0	0	**12**
x2.y6	0	1	11	0	0	0	0	0	0	0	0	**12**
x2.y7	0	0	12	0	0	0	0	0	0	0	0	**12**
x2.y8	0	0	11	0	0	0	0	0	0	0	1	**12**
x2.y9	0	0	12	0	0	0	0	0	0	0	0	**12**
x2.y10	0	0	11	0	0	0	0	0	0	0	0	**11**
x2.y11	0	0	0	0	11	0	0	0	0	0	1	**12**
x2.y12	0	0	0	0	12	0	0	0	0	0	0	**12**
x2.y13	0	0	0	0	11	0	0	0	0	0	1	**12**
x3.y1	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y2	0	0	0	11	0	0	0	0	0	0	1	**12**
x3.y3	0	0	0	11	0	1	0	0	0	0	0	**12**
x3.y4	0	0	0	11	0	0	0	0	0	0	1	**12**
x3.y5	0	5	3	1	0	3	0	0	0	0	0	**12**
x3.y6	0	1	11	0	0	0	0	0	0	0	0	**12**
x3.y7	0	0	11	0	0	0	0	0	0	0	1	**12**
x3.y8	0	0	9	0	2	0	1	0	0	0	0	**12**
x3.y9	0	0	0	0	11	0	1	0	0	0	0	**12**
x3.y10	0	0	0	0	10	0	2	0	0	0	0	**12**
x3.y11	0	0	0	0	11	0	1	0	0	0	0	**12**
x3.y12	0	0	0	0	11	0	0	0	0	0	1	**12**
x3.y13	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y1	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y2	1	0	0	0	0	11	0	0	0	0	0	**12**
x4.y3	0	0	0	1	0	11	0	0	0	0	0	**12**
x4.y4	0	0	0	0	0	11	0	0	0	0	1	**12**
x4.y5	1	0	0	0	0	9	0	2	0	0	0	**12**
x4.y6	1	0	0	0	0	0	0	11	0	0	0	**12**
x4.y7	0	0	0	0	0	0	0	3	0	0	0	**3**
x4.y8	0	0	0	0	0	0	9	2	0	0	1	**12**
x4.y9	0	0	0	0	0	0	11	0	0	0	1	**12**
x4.y10	1	0	0	0	0	0	11	0	0	0	0	**12**
x4.y11	1	0	0	0	0	0	11	0	0	0	0	**12**
x4.y12	0	0	0	0	0	0	11	0	0	0	1	**12**
x4.y13	0	0	0	0	0	0	12	0	0	0	0	**12**
x5.y1	1	0	0	0	0	11	0	0	0	0	0	**12**
x5.y2	1	0	0	0	0	11	0	0	0	0	0	**12**
x5.y3	1	0	0	0	0	9	0	2	0	0	0	**12**
x5.y4	0	0	0	0	0	0	0	11	1	1	0	**13**
x5.y5	1	0	0	0	0	0	0	11	0	0	0	**12**
x5.y6	1	0	0	0	0	0	0	11	0	0	0	**12**
x5.y7	1	0	0	0	0	0	0	11	0	0	0	**12**
x5.y8	0	0	0	0	0	0	0	12	0	0	0	**12**

Table B.17. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y6	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
x5.y9	1	0	0	0	0	0	0	11	0	0	0	**12**
x5.y10	1	0	0	0	0	0	0	0	11	0	0	**12**
x5.y11	0	0	0	0	0	0	0	0	12	0	0	**12**
x5.y12	1	0	0	0	0	0	10	0	1	0	0	**12**
x5.y13	0	0	0	0	0	0	11	0	1	0	0	**12**
x6.y1	1	0	0	0	0	11	0	0	0	0	0	**12**
x6.y2	1	0	0	0	0	1	0	0	0	10	0	**12**
x6.y3	1	0	0	0	0	0	0	0	0	11	0	**12**
x6.y4	0	0	0	0	0	0	0	1	0	11	0	**12**
x6.y5	1	0	0	0	0	0	0	0	0	11	0	**12**
x6.y6	1	0	0	0	0	0	0	0	0	11	0	**12**
x6.y7	0	0	0	0	0	0	0	0	0	12	0	**12**
x6.y8	1	0	0	0	0	0	0	1	0	10	0	**12**
x6.y9	0	0	0	0	0	0	0	1	0	11	0	**12**
x6.y10	1	0	0	0	0	0	0	1	10	0	0	**12**
x6.y11	0	0	0	0	0	0	1	0	11	0	0	**12**
x6.y12	1	0	0	0	0	0	0	0	11	0	0	**12**
x6.y13	1	0	0	0	0	0	0	0	11	0	0	**12**
x7.y1	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y2	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y3	0	0	0	0	0	0	0	0	0	1	11	**12**
x7.y4	1	0	0	0	0	0	0	0	0	0	11	**12**
x7.y5	1	0	0	0	0	0	0	0	0	0	11	**12**
x7.y6	1	0	0	0	0	0	0	0	0	0	11	**12**
x7.y7	0	0	0	0	0	0	0	0	0	11	1	**12**
x7.y8	1	0	0	0	0	0	0	0	0	1	10	**12**
x7.y9	1	1	0	0	0	0	0	0	0	0	10	**12**
x7.y10	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y11	0	0	0	0	0	0	0	0	9	0	3	**12**
x7.y12	1	0	0	0	0	0	0	0	11	0	0	**12**
x7.y13	1	0	0	0	0	0	0	0	11	0	0	**12**
TOTAL	**124**	**38**	**103**	**101**	**101**	**101**	**104**	**91**	**100**	**101**	**119**	**1,083**

Table B.18. Central County: Decreased Fixed Costs - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	18	0	**18**
	x2.y6	0	0	6	0	**6**
	x2.y7	0	0	18	0	**18**
	x3.y1	18	0	0	0	**18**
	x3.y13	0	18	0	0	**18**
	X4.y1	18	0	0	0	**18**
	x4.y13	1	18	0	0	**19**
	x5.y7	0	0	0	16	**16**
	x5.y13	0	18	0	0	**18**
	x6.y7	1	0	0	18	**19**
	X7.y7	0	0	0	19	**19**
TOTAL		**38**	**54**	**42**	**53**	**187**

Table B.19. Central County: Decreased Fixed Costs - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

	LICENSED DEALER LOCATION											
FARM LOCATION	x1.y7	x2.y6	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
x1.y1	1,275	0	0	13,033	0	0	0	0	0	0	0	**14,308**
x1.y2	0	283	0	14,025	0	0	0	0	0	0	0	**14,308**
x1.y3	10,483	1,275	2,550	0	0	0	0	0	0	0	0	**14,308**
x1.y4	13,033	0	1,275	0	0	0	0	0	0	0	0	**14,308**
x1.y5	13,033	0	1,275	0	0	0	0	0	0	0	0	**14,308**
x1.y6	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
x1.y7	5,383	0	8,925	0	0	0	0	0	0	0	0	**14,308**
x1.y8	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
x1.y9	13,033	0	1,275	0	0	0	0	0	0	0	0	**14,308**
x1.y10	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
x1.y11	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
x1.y12	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x1.y13	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x2.y1	0	873	0	13,435	0	0	0	0	0	0	0	**14,308**
x2.y2	0	283	0	14,025	0	0	0	0	0	0	0	**14,308**
x2.y3	0	1,558	0	12,750	0	0	0	0	0	0	0	**14,308**
x2.y4	0	14,308	0	0	0	0	0	0	0	0	0.	**14,308**
x2.y5	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
x2.y6	0	1,179	13,129	0	0	0	0	0	0	0	0	**14,308**
x2.y7	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
x2.y8	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
x2.y9	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
x2.y10	0	0	13,097	0	0	0	0	0	0	0	1,211	**14,308**
x2.y11	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x2.y12	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x2.y13	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x3.y1	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
x3.y2	0	0	0	14,025	0	0	0	0	0	0	283	**14,308**
x3.y3	0	0	0	13,824	0	484	0	0	0	0	0	**14,308**
x3.y4	0	0	0	14,025	0	0	0	0	0	0	283	**14,308**
x3.y5	0	5,383	3,825	1,275	0	3,825	0	0	0	0	0	**14,308**
x3.y6	0	1,275	13,033	0	0	0	0	0	0	0	0	**14,308**
x3.y7	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
x3.y8	0	0	10,950	0	2,083	0	1,275	0	0	0	0	**14,308**
x3.y9	0	0	0	0	13,173	0	1,135	0	0	0	0	**14,308**
x3.y10	0	0	0	0	11,758	0	2,550	0	0	0	0	**14,308**
x3.y11	0	0	0	0	14,025	0	283	0	0	0	0	**14,308**
x3.y12	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x3.y13	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x4.y1	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x4.y2	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x4.y3	0	0	0	1,275	0	13,033	0	0	0	0	0	**14,308**
x4.y4	0	0	0	0	0	14,025	0	0	0	0	283	**14,308**
x4.y5	283	0	0	0	0	11,475	0	2,550	0	0	0	**14,308**
x4.y6	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x4.y7	0	0	0	0	0	0	0	3,580	0	0	0	**3,580**
x4.y8	0	0	0	0	0	0	11,475	2,550	0	0	283	**14,308**
x4.y9	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
x4.y10	283	0	0	0	0	0	14,025	0	0	0	0	**14,308**
x4.y11	283	0	0	0	0	0	14,025	0	0	0	0	**14,308**
x4.y12	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
x4.y13	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x5.y1	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x5.y2	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x5.y3	283	0	0	0	0	11,475	0	2,550	0	0	0	**14,308**
x5.y4	0	0	0	0	0	0	0	12,549	767	992	0	**14,308**
x5.y5	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x5.y6	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x5.y7	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x5.y8	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y9	283	0	0	0	0	0	0	14,025	0	0	0	**14,308**
x5.y10	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x5.y11	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x5.y12	283	0	0	0	0	0	12,750	0	1,275	0	0	**14,308**
x5.y13	0	0	0	0	0	0	13,033	0	1,275	0	0	**14,308**
x6.y1	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x6.y2	283	0	0	0	0	1,275	0	0	0	12,750	0	**14,308**
x6.y3	283	0	0	0	0	0	0	0	0	14,025	0	**14,308**
x6.y4	0	0	0	0	0	0	0	283	0	14,025	0	**14,308**
x6.y5	283	0	0	0	0	0	0	0	0	14,025	0	**14,308**
x6.y6	283	0	0	0	0	0	0	0	0	14,025	0	**14,308**
x6.y7	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y8	283	0	0	0	0	0	0	1,275	0	12,750	0	**14,308**
x6.y9	0	0	0	0	0	0	0	283	0	14,025	0	**14,308**
x6.y10	283	0	0	0	0	0	0	1,275	12,750	0	0	**14,308**
x6.y11	0	0	0	0	0	0	283	0	14,025	0	0	**14,308**
x6.y12	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x6.y13	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x7.y1	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**

Table B.19. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y6	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
x7.y2	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y3	0	0	0	0	0	0	0	0	0	1,275	13,033	**14,308**
x7.y4	919	0	0	0	0	0	0	0	0	0	13,389	**14,308**
x7.y5	1,275	0	0	0	0	0	0	0	0	0	13,033	**14,308**
x7.y6	1,275	0	0	0	0	0	0	0	0	0	13,033	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	14,025	283	**14,308**
x7.y8	1,275	0	0	0	0	0	0	0	0	1,275	11,758	**14,308**
x7.y9	1,275	1,275	0	0	0	0	0	0	0	0	11,758	**14,308**
x7.y10	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y11	0	0	0	0	0	0	0	0	11,475	0	2,833	**14,308**
x7.y12	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x7.y13	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
TOTAL	**126,000**	**42,000**	**126,000**	**126,000**	**125,472**	**126,000**	**127,500**	**111,328**	**126,000**	**127,500**	**127,500**	**1,291,300**

Table B.20. Central County: Decreased Fixed Costs - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	X1.y7	0	0	126,000	0	**126,000**
	x2.y6	0	0	42,000	0	**42,000**
	x2.y7	0	0	126,000	0	**126,000**
	x3.y1	126,000	0	0	0	**126,000**
	x3.y13	0	126,000	0	0	**126,000**
	X4.y1	126,000	0	0	0	**126,000**
	x4.y13	7,000	126,000	0	0	**133,000**
	x5.y7	0	0	0	112,000	**112,000**
	x5.y13	0	126,000	0	0	**126,000**
	x6.y7	7,000	0	0	126,000	**133,000**
	X7.y7	0	0	0	133,000	**133,000**
TOTAL		**266,000**	**378,000**	**294,000**	**371,000**	**1,309,000**

Table B.21. Central County: Increased Manufacturers' Transport Costs - Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION											
		x1.y7	x1.y13	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	0	11	0	0	0	0	0	1	**12**
	x1.y2	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y3	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y4	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y5	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y6	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y7	11	0	1	0	0	0	0	0	0	0	0	**12**
	x1.y8	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y9	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y10	9	0	0	2	0	0	0	0	0	0	1	**12**
	x1.y11	0	7	0	5	0	0	0	0	0	0	0	**12**
	x1.y12	0	10	0	2	0	0	0	0	0	0	0	**12**
	x1.y13	0	1	0	11	0	0	0	0	0	0	0	**12**
	x2.y1	0	0	0	0	11	0	0	0	0	0	1	**12**
	x2.y2	0	0	0	0	11	0	0	0	0	0	1	**12**
	x2.y3	0	0	0	0	11	0	0	0	0	0	1	**12**
	x2.y4	0	0	11	0	0	0	0	0	0	0	1	**12**
	x2.y5	0	0	11	0	0	0	0	0	0	0	1	**12**
	x2.y6	0	0	11	0	0	0	0	0	0	0	1	**12**
	x2.y7	0	0	11	0	0	0	0	0	0	0	1	**12**
	x2.y8	0	1	11	0	0	0	0	0	0	0	0	**12**

Table B.21. (continued)

	LICENSED DEALER LOCATION											
	x1,y7	x1,y13	x2,y7	x2,y13	x3,y1	x4,y1	x4,y13	x5,y7	x5,y13	x6,y7	x7,y7	TOTAL
x2,y9	0	1	0	11	0	0	0	0	0	0	0	12
x2,y10	0	1	0	11	0	0	0	0	0	0	0	12
x2,y11	0	0	0	11	0	0	0	0	0	0	1	12
x2,y12	0	0	0	12	0	0	0	0	0	0	0	12
x2,y13	0	0	0	12	0	0	0	0	0	0	0	12
x3,y1	0	0	0	0	12	0	0	0	0	0	0	12
x3,y2	0	0	0	0	12	0	0	0	0	0	0	12
x3,y3	0	0	0	0	11	0	0	0	0	0	1	12
x3,y4	0	0	0	0	11	0	0	0	0	0	1	12
x3,y5	0	0	6	0	6	0	0	0	0	0	0	12
x3,y6	0	0	12	0	0	0	0	0	0	0	0	12
x3,y7	0	0	11	0	0	0	0	0	0	0	1	12
x3,y8	0	0	11	1	0	0	0	0	0	0	0	12
x3,y9	0	0	3	0	0	0	9	0	0	0	0	12
x3,y10	0	0	0	1	0	0	11	0	0	0	0	12
x3,y11	0	0	0	11	0	0	1	0	0	0	0	12
x3,y12	0	0	0	0	0	0	11	0	0	0	1	12
x3,y13	0	0	0	1	0	0	10	0	0	0	1	12
x4,y1	0	0	0	0	1	11	0	0	0	0	0	12
x4,y2	0	0	0	0	1	11	0	0	0	0	0	12
x4,y3	0	0	0	0	0	11	0	0	0	0	1	12
x4,y4	0	1	0	0	0	11	0	0	0	0	0	12
x4,y5	0	1	0	0	0	0	0	11	0	0	0	12
x4,y6	0	0	0	0	0	0	0	12	0	0	0	12
x4,y7	0	0	3	0	0	0	0	0	0	0	0	3
x4,y8	0	0	0	0	0	0	5	7	0	0	0	12
x4,y9	0	0	0	0	0	0	11	0	0	0	1	12
x4,y10	0	0	0	0	0	0	11	0	0	0	1	12
x4,y11	0	0	0	0	0	0	12	0	0	0	0	12
x4,y12	0	0	0	0	0	0	11	0	0	0	1	12
x4,y13	0	0	0	11	0	0	0	0	1	0	0	12
x5,y1	0	0	0	1	0	11	0	0	0	0	0	12
x5,y2	0	1	0	0	0	11	0	0	0	0	0	12
x5,y3	0	1	0	0	0	9	0	2	0	0	0	12
x5,y4	0	0	0	0	0	1	0	11	0	0	0	12
x5,y5	0	1	0	0	0	0	0	11	0	0	0	12
x5,y6	0	0	0	0	0	0	0	12	0	0	0	12
x5,y7	0	0	0	0	0	0	0	12	0	0	0	12
x5,y8	0	0	0	0	0	0	0	12	0	0	0	12
x5,y9	0	0	0	0	0	0	0	11	0	1	0	12
x5,y10	0	0	0	0	0	0	1	0	11	0	0	12
x5,y11	0	0	0	0	1	0	1	0	10	0	0	12
x5,y12	1	0	0	0	0	0	1	0	10	0	0	12
x5,y13	0	0	0	0	0	0	7	0	5	0	0	12
x6,y1	0	1	0	0	0	11	0	0	0	0	0	12
x6,y2	0	1	0	0	0	2	0	0	0	9	0	12
x6,y3	0	0	0	0	0	0	0	1	0	11	0	12
x6,y4	0	0	0	0	0	0	0	1	0	11	0	12
x6,y5	0	1	0	0	0	0	0	0	0	11	0	12
x6,y6	0	1	0	0	0	0	0	1	0	10	0	12
x6,y7	0	0	0	0	0	0	0	0	0	12	0	12
x6,y8	0	1	0	0	0	0	0	1	0	10	0	12
x6,y9	0	0	0	0	1	0	0	0	0	11	0	12
x6,y10	0	0	0	0	0	0	0	0	1	11	0	12
x6,y11	0	0	0	0	1	0	0	0	11	0	0	12
x6,y12	0	0	0	0	1	0	0	0	11	0	0	12
x6,y13	0	0	0	0	0	0	0	0	12	0	0	12
x7,y1	0	1	0	0	0	11	0	0	0	0	0	12
x7,y2	0	1	0	0	0	0	0	0	0	0	11	12
x7,y3	0	1	0	0	0	0	0	0	0	0	11	12
x7,y4	0	0	0	0	0	0	0	0	0	0	12	12

Table B.21. (continued)

		LICENSED DEALER LOCATION											
		x1.y7	x1.y13	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
	x7.y5	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y6	0	1	0	0	0	0	0	0	0	0	11	**12**
	x7.y7	0	0	0	0	0	0	0	0	0	4	8	**12**
	x7.y8	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y9	0	0	0	0	0	0	0	0	0	1	11	**12**
	x7.y10	0	0	0	0	1	0	0	0	0	0	11	**12**
	x7.y11	0	0	0	0	0	0	0	0	9	0	3	**12**
	x7.y12	0	0	0	0	0	0	0	0	12	0	0	**12**
	x7.y13	1	0	0	0	0	0	0	0	11	0	0	**12**
TOTAL		**102**	**35**	**102**	**103**	**103**	**100**	**102**	**105**	**104**	**102**	**125**	**1,083**

Table B.22. Central County: Increased Manufacturers' Transport Costs - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	0	0	18	0	**18**
	x1.y13	0	4	0	0	**4**
	x2.y7	0	0	18	0	**18**
	x2.y13	0	18	0	0	**18**
	x3.y1	18	0	0	0	**18**
	X4.y1	18	0	0	0	**18**
	x4.y13	1	18	0	0	**19**
	x5.y7	1	0	0	18	**19**
	x5.y13	0	18	0	0	**18**
	x6.y7	0	0	0	18	**18**
	X7.y7	0	0	0	19	**19**
TOTAL		**38**	**58**	**36**	**55**	**187**

Table B.23. Central County: Increased Manufacturers' Transport Costs - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION											
		x1.y7	x1.y13	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
	x1.y2	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y3	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y4	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y5	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y6	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y7	13,862	0	446	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y9	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y10	11,475	0	0	2,550	0	0	0	0	0	0	283	**14,308**
	x1.y11	0	8,172	0	6,136	0	0	0	0	0	0	0	**14,308**
	x1.y12	0	11,758	0	2,550	0	0	0	0	0	0	0	**14,308**
	x1.y13	0	283	0	14,025	0	0	0	0	0	0	0	**14,308**
	x2.y1	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
	x2.y2	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
	x2.y3	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
	x2.y4	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x2.y5	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x2.y6	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x2.y7	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x2.y8	0	283	14,025	0	0	0	0	0	0	0	0	**14,308**
	x2.y9	0	283	0	14,025	0	0	0	0	0	0	0	**14,308**
	x2.y10	0	283	0	14,025	0	0	0	0	0	0	0	**14,308**
	x2.y11	0	0	0	14,025	0	0	0	0	0	0	283	**14,308**
	x2.y12	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y13	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y1	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y2	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**

Table B.23. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x1.y13	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y7	**TOTAL**
x3.y3	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x3.y4	0	0	0	0	14,025	0	0	0	0	0	283	**14,308**
x3.y5	0	0	6,658	0	7,650	0	0	0	0	0	0	**14,308**
x3.y6	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
x3.y7	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
x3.y8	0	0	13,033	1,275	0	0	0	0	0	0	0	**14,308**
x3.y9	0	0	3,825	0	0	0	10,483	0	0	0	0	**14,308**
x3.y10	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x3.y11	0	0	0	13,033	0	0	1,275	0	0	0	0	**14,308**
x3.y12	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
x3.y13	0	0	0	1,275	0	0	12,750	0	0	0	283	**14,308**
x4.y1	0	0	0	0	304	14,004	0	0	0	0	0	**14,308**
x4.y2	0	0	0	0	1,275	13,033	0	0	0	0	0	**14,308**
x4.y3	0	0	0	0	0	14,025	0	0	0	0	283	**14,308**
x4.y4	0	283	0	0	0	14,025	0	0	0	0	0	**14,308**
x4.y5	0	283	0	0	0	0	0	14,025	0	0	0	**14,308**
x4.y6	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x4.y7	0	0	3,580	0	0	0	0	0	0	0	0	**3,580**
x4.y8	0	0	0	0	0	0	6,375	7,933	0	0	0	**14,308**
x4.y9	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
x4.y10	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
x4.y11	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x4.y12	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
x4.y13	0	0	0	13,899	0	0	0	0	409	0	0	**14,308**
x5.y1	0	0	0	283	0	14,025	0	0	0	0	0	**14,308**
x5.y2	0	283	0	0	0	14,025	0	0	0	0	0	**14,308**
x5.y3	0	283	0	0	0	11,475	0	2,550	0	0	0	**14,308**
x5.y4	0	0	0	0	0	788	0	13,520	0	0	0	**14,308**
x5.y5	0	283	0	0	0	0	0	14,025	0	0	0	**14,308**
x5.y6	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y7	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y8	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y9	0	0	0	0	0	0	0	13,115	0	1,193	0	**14,308**
x5.y10	0	0	0	0	0	0	283	0	14,025	0	0	**14,308**
x5.y11	0	0	0	0	1,275	0	1,275	0	11,758	0	0	**14,308**
x5.y12	283	0	0	0	0	0	1,275	0	12,750	0	0	**14,308**
x5.y13	0	0	0	0	0	0	8,232	0	6,076	0	0	**14,308**
x6.y1	0	283	0	0	0	14,025	0	0	0	0	0	**14,308**
x6.y2	0	283	0	0	0	2,550	0	0	0	11,475	0	**14,308**
x6.y3	0	0	0	0	0	0	0	1,275	0	13,033	0	**14,308**
x6.y4	0	0	0	0	0	0	0	1,275	0	13,033	0	**14,308**
x6.y5	0	283	0	0	0	0	0	0	0	14,025	0	**14,308**
x6.y6	0	283	0	0	0	0	0	1,275	0	12,750	0	**14,308**
x6.y7	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y8	0	283	0	0	0	0	0	1,275	0	12,750	0	**14,308**
x6.y9	0	0	0	0	283	0	0	0	0	14,025	0	**14,308**
x6.y10	0	0	0	0	0	0	0	0	1,275	13,033	0	**14,308**
x6.y11	0	0	0	0	889	0	0	0	13,419	0	0	**14,308**
x6.y12	0	0	0	0	283	0	0	0	14,025	0	0	**14,308**
x6.y13	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x7.y1	0	283	0	0	0	14,025	0	0	0	0	0	**14,308**
x7.y2	0	1,275	0	0	0	0	0	0	0	0	13,033	**14,308**
x7.y3	0	1,275	0	0	0	0	0	0	0	0	13,033	**14,308**
x7.y4	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y5	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y6	0	1,275	0	0	0	0	0	0	0	0	13,033	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	5,100	9,208	**14,308**
x7.y8	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	1,275	13,033	**14,308**
x7.y10	0	0	0	0	1,275	0	0	0	0	0	13,033	**14,308**
x7.y11	0	0	0	0	0	0	0	0	10,614	0	3,694	**14,308**
x7.y12	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x7.y13	1,275	0	0	0	0	0	0	0	13,033	0	0	**14,308**
TOTAL	**125,919**	**28,000**	**126,000**	**126,000**	**126,000**	**126,000**	**126,381**	**127,500**	**126,000**	**126,000**	**127,500**	**1,291,300**

Table B.24. Central County: Increased Manufacturers' Transport Costs - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	0	0	126,000	0	**126,000**
	x1.y13	0	28,000	0	0	**28,000**
	x2.y7	0	0	126,000	0	**126,000**
	x2.y13	0	126,000	0	0	**126,000**
	x3.y1	126,000	0	0	0	**126,000**
	X4.y1	126,000	0	0	0	**126,000**
	x4.y13	7,000	126,000	0	0	**133,000**
	x5.y7	7,000	0	0	126,000	**133,000**
	x5.y13	0	126,000	0	0	**126,000**
	x6.y7	0	0	0	126,000	**126,000**
	X7.y7	0	0	0	133,000	**133,000**
TOTAL		**266,000**	**406,000**	**252,000**	**385,000**	**1,309,000**

Table B.25. Central County: Decreased Manufacturers' Transport Costs - Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION										
		x1.y7	x2.y6	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y1	x5.y13	x6.y7	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	0	11	0	0	0	1	0	0	**12**
	x1.y2	8	2	0	0	1	0	0	0	1	0	0	**12**
	x1.y3	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y4	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y5	10	0	0	0	0	0	0	0	0	0	2	**12**
	x1.y6	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y7	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y8	11	0	0	0	0	0	0	0	0	0	1	**12**
	x1.y9	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y10	11	0	0	0	0	0	0	1	0	0	0	**12**
	x1.y11	1	0	0	11	0	0	0	0	0	0	0	**12**
	x1.y12	0	0	0	11	0	0	0	0	0	0	1	**12**
	x1.y13	0	0	0	12	0	0	0	0	0	0	0	**12**
	x2.y1	0	0	0	0	11	0	0	0	1	0	0	**12**
	x2.y2	0	0	0	0	12	0	0	0	0	0	0	**12**
	x2.y3	0	1	0	0	11	0	0	0	0	0	0	**12**
	x2.y4	0	1	8	0	3	0	0	0	0	0	0	**12**
	x2.y5	0	11	1	0	0	0	0	0	0	0	0	**12**
	x2.y6	0	0	11	0	0	0	0	0	0	0	1	**12**
	x2.y7	0	0	12	0	0	0	0	0	0	0	0	**12**
	x2.y8	0	0	11	0	0	0	0	0	0	0	1	**12**
	x2.y9	0	0	2	9	0	0	0	1	0	0	0	**12**
	x2.y10	0	1	11	0	0	0	0	0	0	0	0	**12**
	x2.y11	0	0	0	11	0	0	0	0	0	0	1	**12**
	x2.y12	0	0	0	12	0	0	0	0	0	0	0	**12**
	x2.y13	0	0	0	12	0	0	0	0	0	0	0	**12**
	x3.y1	0	0	0	0	8	4	0	0	0	0	0	**12**
	x3.y2	0	0	0	0	11	1	0	0	0	0	0	**12**
	x3.y3	0	0	0	0	11	1	0	0	0	0	0	**12**
	x3.y4	0	0	0	0	11	1	0	0	0	0	0	**12**
	x3.y5	0	0	1	0	10	0	0	0	1	0	0	**12**
	x3.y6	0	9	2	0	1	0	0	0	0	0	0	**12**
	x3.y7	0	0	11	0	0	0	0	0	0	0	1	**12**
	x3.y8	0	0	12	0	0	0	0	0	0	0	0	**12**
	x3.y9	0	0	11	0	1	0	0	0	0	0	0	**12**
	x3.y10	0	0	8	0	0	0	4	0	0	0	0	**12**
	x3.y11	0	0	0	0	0	0	12	0	0	0	0	**12**

Table B.25. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y6	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y1	x5.y13	x6.y7	x7.y7	TOTAL
x3.y12	0	0	0	0	0	0	12	0	0	0	0	**12**
x3.y13	0	0	0	11	0	0	0	1	0	0	0	**12**
x4.y1	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y2	0	0	0	1	0	11	0	0	0	0	0	**12**
x4.y3	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y4	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y5	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y6	0	0	0	1	0	11	0	0	0	0	0	**12**
x4.y7	0	0	0	0	0	3	0	0	0	0	0	**3**
x4.y8	0	0	0	1	0	0	11	0	0	0	0	**12**
x4.y9	0	0	0	0	0	1	11	0	0	0	0	**12**
x4.y10	0	0	0	0	0	0	11	0	0	0	1	**12**
x4.y11	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y12	1	0	0	0	0	0	11	0	0	0	0	**12**
x4.y13	0	0	0	0	0	0	12	0	0	0	0	**12**
x5.y1	0	0	0	0	0	9	0	3	0	0	0	**12**
x5.y2	0	0	0	1	0	11	0	0	0	0	0	**12**
x5.y3	0	0	0	0	0	4	0	8	0	0	0	**12**
x5.y4	0	0	0	0	0	1	0	11	0	0	0	**12**
x5.y5	0	0	0	0	0	1	0	11	0	0	0	**12**
x5.y6	0	0	0	1	0	0	0	0	0	11	0	**12**
x5.y7	0	0	1	0	0	0	0	0	0	11	0	**12**
x5.y8	0	0	0	0	0	0	0	0	0	12	0	**12**
x5.y9	1	0	0	0	0	0	0	0	10	1	0	**12**
x5.y10	1	0	0	0	0	0	0	0	11	0	0	**12**
x5.y11	1	0	0	0	0	0	0	0	11	0	0	**12**
x5.y12	1	0	0	0	0	0	0	0	11	0	0	**12**
x5.y13	0	0	0	0	0	0	9	0	3	0	0	**12**
x6.y1	0	0	0	0	0	0	0	12	0	0	0	**12**
x6.y2	0	0	1	0	0	0	0	11	0	0	0	**12**
x6.y3	0	0	0	1	0	0	0	11	0	0	0	**12**
x6.y4	0	0	0	1	0	0	0	10	0	1	0	**12**
x6.y5	0	0	0	1	0	0	0	0	0	11	0	**12**
x6.y6	0	0	0	1	0	0	0	0	0	11	0	**12**
x6.y7	0	0	0	0	0	0	0	0	0	12	0	**12**
x6.y8	0	0	0	1	0	0	0	0	0	11	0	**12**
x6.y9	0	0	0	0	0	0	0	0	0	12	0	**12**
x6.y10	1	0	0	0	0	0	0	0	1	10	0	**12**
x6.y11	1	0	0	0	0	0	0	0	11	0	0	**12**
x6.y12	1	0	0	0	0	0	0	0	11	0	0	**12**
x6.y13	1	0	0	0	0	0	0	0	11	0	0	**12**
x7.y1	0	0	0	0	0	0	0	11	0	0	1	**12**
x7.y2	0	0	0	1	0	0	0	11	0	0	0	**12**
x7.y3	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y4	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y5	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y6	0	0	0	7	0	0	0	0	0	0	5	**12**
x7.y7	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y8	0	0	0	1	0	0	0	0	0	0	11	**12**
x7.y9	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y10	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y11	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y12	0	0	0	0	0	0	0	0	8	0	4	**12**
x7.y13	1	0	0	0	0	0	0	0	11	0	0	**12**
TOTAL	**108**	**25**	**103**	**108**	**102**	**107**	**105**	**102**	**103**	**103**	**117**	**1,083**

Table B.26. Central County: Decreased Manufacturers' Transport Costs - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	1	0	18	0	**19**
	x2.y6	0	0	4	0	**4**
	x2.y7	0	0	18	0	**18**
	x2.y13	0	18	0	0	**18**
	x3.y1	18	0	0	0	**18**
	X4.y1	18	1	0	0	**19**
	x4.y13	0	18	0	0	**18**
	x5.y1	18	0	0	0	**18**
	x5.y13	0	18	0	0	**18**
	x6.y7	0	0	0	18	**18**
	X7.y7	1	0	0	18	**19**
TOTAL		**56**	**55**	**40**	**36**	**187**

Table B.27. Central County: Decreased Manufacturers' Transport Costs - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION										
		x1.y7	x2.y6	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y1	x5.y13	x6.y7	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	0	14,025	0	0	0	283	0	0	**14,308**
	x1.y2	10,107	1,651	0	0	1,275	0	0	0	1,275	0	0	**14,308**
	x1.y3	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y4	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y5	12,750	0	0	0	0	0	0	0	0	0	1,558	**14,308**
	x1.y6	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y7	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
	x1.y9	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y10	13,033	0	0	0	0	0	0	1,275	0	0	0	**14,308**
	x1.y11	283	0	0	14,025	0	0	0	0	0	0	0	**14,308**
	x1.y12	0	0	0	13,876	0	0	0	0	0	0	432	**14,308**
	x1.y13	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y1	0	0	0	0	14,025	0	0	0	283	0	0	**14,308**
	x2.y2	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x2.y3	0	1,275	0	0	13,033	0	0	0	0	0	0	**14,308**
	x2.y4	0	1,275	9,971	0	3,062	0	0	0	0	0	0	**14,308**
	x2.y5	0	13,033	1,275	0	0	0	0	0	0	0	0	**14,308**
	x2.y6	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x2.y7	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x2.y8	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x2.y9	0	0	1,558	11,475	0	0	0	1,275	0	0	0	**14,308**
	x2.y10	0	283	14,025	0	0	0	0	0	0	0	0	**14,308**
	x2.y11	0	0	0	14,025	0	0	0	0	0	0	283	**14,308**
	x2.y12	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y13	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y1	0	0	0	0	10,200	4,108	0	0	0	0	0	**14,308**
	x3.y2	0	0	0	0	14,025	283	0	0	0	0	0	**14,308**
	x3.y3	0	0	0	0	13,033	1,275	0	0	0	0	0	**14,308**
	x3.y4	0	0	0	0	13,714	594	0	0	0	0	0	**14,308**
	x3.y5	0	0	283	0	12,750	0	0	0	1,275	0	0	**14,308**
	x3.y6	0	10,483	2,550	0	1,275	0	0	0	0	0	0	**14,308**
	x3.y7	0	0	14,025	0	0	0	0	0	0	0	283	**14,308**
	x3.y8	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x3.y9	0	0	13,033	0	1,275	0	0	0	0	0	0	**14,308**
	x3.y10	0	0	10,064	0	0	0	4,244	0	0	0	0	**14,308**
	x3.y11	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x3.y12	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x3.y13	0	0	0	13,033	0	0	0	1,275	0	0	0	**14,308**
	x4.y1	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y2	0	0	0	636	0	13,672	0	0	0	0	0	**14,308**
	x4.y3	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y4	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y5	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y6	0	0	0	1,275	0	13,033	0	0	0	0	0	**14,308**
	x4.y7	0	0	0	0	0	3,580	0	0	0	0	0	**3,580**
	x4.y8	0	0	0	1,275	0	0	13,033	0	0	0	0	**14,308**
	x4.y9	0	0	0	0	0	1,275	13,033	0	0	0	0	**14,308**
	x4.y10	0	0	0	0	0	0	14,025	0	0	0	283	**14,308**
	x4.y11	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y12	358	0	0	0	0	0	13,950	0	0	0	0	**14,308**

Table B.27. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y6	x2.y7	x2.y13	x3.y1	x4.y1	x4.y13	x5.y1	x5.y13	x6.y7	x7.y7	TOTAL
x4.y13	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x5.y1	0	0	0	0	0	10,483	0	3,825	0	0	0	**14,308**
x5.y2	0	0	0	283	0	14,025	0	0	0	0	0	**14,308**
x5.y3	0	0	0	0	0	5,100	0	9,208	0	0	0	**14,308**
x5.y4	0	0	0	0	0	1,275	0	13,033	0	0	0	**14,308**
x5.y5	0	0	0	0	0	365	0	13,943	0	0	0	**14,308**
x5.y6	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x5.y7	0	0	1,275	0	0	0	0	0	0	13,033	0	**14,308**
x5.y8	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x5.y9	1,275	0	0	0	0	0	0	0	12,123	910	0	**14,308**
x5.y10	1,275	0	0	0	0	0	0	0	13,033	0	0	**14,308**
x5.y11	1,275	0	0	0	0	0	0	0	13,033	0	0	**14,308**
x5.y12	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x5.y13	0	0	0	0	0	0	10,483	0	3,825	0	0	**14,308**
x6.y1	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x6.y2	0	0	1,275	0	0	0	0	13,033	0	0	0	**14,308**
x6.y3	0	0	0	283	0	0	0	14,025	0	0	0	**14,308**
x6.y4	0	0	0	1,275	0	0	0	12,750	0	283	0	**14,308**
x6.y5	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x6.y6	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x6.y7	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y8	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x6.y9	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y10	283	0	0	0	0	0	0	0	1,275	12,750	0	**14,308**
x6.y11	1,013	0	0	0	0	0	0	0	13,295	0	0	**14,308**
x6.y12	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x6.y13	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x7.y1	0	0	0	0	0	0	0	14,025	0	0	283	**14,308**
x7.y2	0	0	0	283	0	0	0	14,025	0	0	0	**14,308**
x7.y3	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y4	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y5	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y6	0	0	0	8,925	0	0	0	0	0	0	5,383	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y8	0	0	0	1,275	0	0	0	0	0	0	13,033	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y10	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y11	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y12	0	0	0	0	0	0	0	0	10,200	0	4,108	**14,308**
x7.y13	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
TOTAL	**127,500**	**28,000**	**126,000**	**126,000**	**126,000**	**126,300**	**126,000**	**126,000**	**126,000**	**126,000**	**127,500**	**1,291,300**

Table B.28. Central County: Decreased Manufacturers' Transport Costs - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	**m2**	**m3**	**m4**	**TOTAL**
LICENSED DEALER LOCATION	**x1.y7**	7,000	0	126,000	0	**133,000**
	x2.y6	0	0	28,000	0	**28,000**
	x2.y7	0	0	126,000	0	**126,000**
	x2.y13	0	126,000	0	0	**126,000**
	x3.y1	126,000	0	0	0	**126,000**
	X4.y1	126,000	7,000	0	0	**133,000**
	x4.y13	0	126,000	0	0	**126,000**
	x5.y1	126,000	0	0	0	**126,000**
	x5.y13	0	126,000	0	0	**126,000**
	x6.y7	0	0	0	126,000	**126,000**
	X7.y7	7,000	0	0	126,000	**133,000**
TOTAL		**392,000**	**385,000**	**280,000**	**252,000**	**1,309,000**

Table B.29. Central County: Increased Farmers' Transport Costs - Number of Trips from Farm to Licensed Dealer

	LICENSED DEALER LOCATION											
FARM LOCATION	x1.y2	x1.y6	x2.y4	x3.y13	x4.y1	x4.y6	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	TOTAL
x1.y1	11	1	0	0	0	0	0	0	0	0	0	**12**
x1.y2	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y3	11	0	0	0	0	0	0	0	0	0	1	**12**
x1.y4	11	1	0	0	0	0	0	0	0	0	0	**12**
x1.y5	6	5	0	0	1	0	0	0	0	0	0	**12**
x1.y6	0	12	0	0	0	0	0	0	0	0	0	**12**
x1.y7	1	11	0	0	0	0	0	0	0	0	0	**12**
x1.y8	1	11	0	0	0	0	0	0	0	0	0	**12**
x1.y9	0	11	0	0	0	0	0	0	0	0	1	**12**
x1.y10	0	11	0	0	0	0	0	0	0	0	1	**12**
x1.y11	0	10	1	0	0	0	0	0	0	0	1	**12**
x1.y12	1	0	0	10	0	0	0	0	0	0	1	**12**
x1.y13	0	0	0	11	0	0	0	0	0	0	1	**12**
x2.y1	11	0	0	0	0	0	0	0	0	0	1	**12**
x2.y2	11	0	0	0	0	0	0	0	0	0	1	**12**
x2.y3	11	0	1	0	0	0	0	0	0	0	0	**12**
x2.y4	7	0	4	0	0	0	0	0	0	0	1	**12**
x2.y5	2	0	9	0	0	0	0	0	0	0	1	**12**
x2.y6	0	12	0	0	0	0	0	0	0	0	0	**12**
x2.y7	0	6	5	0	0	0	0	0	0	0	1	**12**
x2.y8	0	4	6	1	0	0	0	0	0	1	0	**12**
x2.y9	0	9	1	2	0	0	0	0	0	0	0	**12**
x2.y10	1	0	0	11	0	0	0	0	0	0	0	**12**
x2.y11	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y12	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y13	0	0	0	11	0	0	1	0	0	0	0	**12**
x3.y1	0	0	0	0	12	0	0	0	0	0	0	**12**
x3.y2	1	0	0	0	11	0	0	0	0	0	0	**12**
x3.y3	0	0	1	0	10	0	0	0	0	0	1	**12**
x3.y4	0	0	11	0	0	1	0	0	0	0	0	**12**
x3.y5	0	0	0	0	1	11	0	0	0	0	0	**12**
x3.y6	0	0	0	0	0	11	0	0	0	0	1	**12**
x3.y7	0	0	0	1	0	11	0	0	0	0	0	**12**
x3.y8	0	0	0	0	0	4	8	0	0	0	0	**12**
x3.y9	0	0	0	11	0	0	1	0	0	0	0	**12**
x3.y10	0	0	0	11	0	0	1	0	0	0	0	**12**
x3.y11	0	0	0	1	0	0	11	0	0	0	0	**12**
x3.y12	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y13	0	0	0	1	0	0	11	0	0	0	0	**12**
x4.y1	0	0	0	0	12	0	0	0	0	0	0	**12**
x4.y2	0	0	0	0	12	0	0	0	0	0	0	**12**
x4.y3	0	0	0	0	10	1	0	0	0	0	1	**12**
x4.y4	0	0	0	0	0	11	0	0	0	0	1	**12**
x4.y5	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y6	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y7	0	0	0	0	0	3	0	0	0	0	0	**3**
x4.y8	0	0	0	0	0	2	9	1	0	0	0	**12**
x4.y9	0	0	0	0	0	0	11	0	1	0	0	**12**
x4.y10	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y11	0	0	0	0	0	0	11	1	0	0	0	**12**
x4.y12	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y13	0	0	0	0	0	0	12	0	0	0	0	**12**
x5.y1	0	1	0	0	11	0	0	0	0	0	0	**12**
x5.y2	0	1	0	0	2	0	0	9	0	0	0	**12**
x5.y3	0	1	0	0	2	0	0	9	0	0	0	**12**
x5.y4	0	1	0	0	0	0	0	11	0	0	0	**12**
x5.y5	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y6	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y7	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y8	0	0	0	0	0	0	0	12	0	0	0	**12**

Table B.29. (continued)

	LICENSED DEALER LOCATION											
	x1.y2	x1.y6	x2.y4	x3.y13	x4.y1	x4.y6	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	TOTAL
x5.y9	0	0	0	0	0	0	0	11	1	0	0	**12**
x5.y10	0	0	0	0	0	0	0	8	4	0	0	**12**
x5.y11	0	0	0	0	0	0	0	0	12	0	0	**12**
x5.y12	0	0	0	0	0	0	0	0	12	0	0	**12**
x5.y13	0	0	0	0	0	0	3	0	9	0	0	**12**
x6.y1	0	0	0	0	11	0	0	0	0	1	0	**12**
x6.y2	0	0	0	1	7	0	0	0	0	4	0	**12**
x6.y3	0	0	0	0	1	0	0	0	0	11	0	**12**
x6.y4	0	0	0	0	0	0	0	0	0	11	1	**12**
x6.y5	0	1	0	0	0	0	0	0	0	11	0	**12**
x6.y6	1	0	0	0	0	1	0	0	0	10	0	**12**
x6.y7	0	0	0	0	0	0	0	6	0	6	0	**12**
x6.y8	1	0	0	0	0	0	0	0	0	11	0	**12**
x6.y9	0	0	0	0	0	0	0	0	0	12	0	**12**
x6.y10	1	0	0	0	0	0	0	0	0	11	0	**12**
x6.y11	0	0	0	0	0	0	0	0	11	1	0	**12**
x6.y12	1	0	0	0	0	0	0	0	11	0	0	**12**
x6.y13	1	0	0	0	0	0	0	0	11	0	0	**12**
x7.y1	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y2	0	1	0	0	0	0	0	0	0	1	10	**12**
x7.y3	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y4	0	0	0	0	0	0	0	0	0	1	11	**12**
x7.y5	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y6	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y7	0	0	0	0	0	0	0	0	0	2	10	**12**
x7.y8	1	0	0	0	0	0	0	1	0	1	9	**12**
x7.y9	0	0	0	0	0	0	0	0	0	2	10	**12**
x7.y10	0	0	0	0	0	0	0	0	0	11	1	**12**
x7.y11	0	0	0	0	0	0	0	1	11	0	0	**12**
x7.y12	1	0	0	0	0	0	0	0	11	0	0	**12**
x7.y13	0	1	0	0	0	0	0	0	11	0	0	**12**
TOTAL	**105**	**111**	**39**	**108**	**103**	**80**	**103**	**106**	**105**	**108**	**115**	**1,083**

Table B.30. Central County: Increased Farmers' Transport Costs - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y2	0	0	18	1	**19**
	x1.y6	0	0	18	0	**18**
	x2.y4	0	0	7	0	**7**
	x3.y13	0	19	0	0	**19**
	x4.y1	18	1	0	0	**19**
	x4.y6	0	0	0	14	**14**
	x4.y13	0	18	0	0	**18**
	x5.y7	0	19	0	0	**19**
	x5.y13	0	19	0	0	**19**
	x6.y7	0	0	0	19	**19**
	X7.y6	0	0	0	19	**19**
TOTAL		**18**	**76**	**43**	**53**	**190**

Table B.31. Central County: Increased Farmers' Transport Costs - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

	LICENSED DEALER LOCATION											
FARM LOCATION	x1.y2	x1.y6	x2.y4	x3.y13	x4.y1	x4.y6	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	TOTAL
x1.y1	14,025	283	0	0	0	0	0	0	0	0	0	**14,308**
x1.y2	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
x1.y3	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
x1.y4	14,025	283	0	0	0	0	0	0	0	0	0	**14,308**
x1.y5	7,650	5,383	0	0	1,275	0	0	0	0	0	0	**14,308**
x1.y6	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
x1.y7	1,275	13,033	0	0	0	0	0	0	0	0	0	**14,308**
x1.y8	928	13,380	0	0	0	0	0	0	0	0	0	**14,308**
x1.y9	0	13,033	0	0	0	0	0	0	0	0	1,275	**14,308**
x1.y10	0	13,033	0	0	0	0	0	0	0	0	1,275	**14,308**
x1.y11	0	11,758	1,275	0	0	0	0	0	0	0	1,275	**14,308**
x1.y12	1,275	0	0	12,105	0	0	0	0	0	0	928	**14,308**
x1.y13	0	0	0	14,025	0	0	0	0	0	0	283	**14,308**
x2.y1	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
x2.y2	14,025	0	0	0	0	0	0	0	0	0	283	**14,308**
x2.y3	13,758	0	550	0	0	0	0	0	0	0	0	**14,308**
x2.y4	8,925	0	5,100	0	0	0	0	0	0	0	283	**14,308**
x2.y5	2,550	0	11,475	0	0	0	0	0	0	0	283	**14,308**
x2.y6	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
x2.y7	0	6,658	6,375	0	0	0	0	0	0	0	1,275	**14,308**
x2.y8	0	5,100	7,650	1,275	0	0	0	0	0	283	0	**14,308**
x2.y9	0	11,475	1,275	1,558	0	0	0	0	0	0	0	**14,308**
x2.y10	283	0	0	14,025	0	0	0	0	0	0	0	**14,308**
x2.y11	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
x2.y12	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
x2.y13	0	0	0	13,033	0	0	1,275	0	0	0	0	**14,308**
x3.y1	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x3.y2	919	0	0	0	13,389	0	0	0	0	0	0	**14,308**
x3.y3	0	0	1,275	0	12,750	0	0	0	0	0	283	**14,308**
x3.y4	0	0	14,025	0	0	283	0	0	0	0	0	**14,308**
x3.y5	0	0	0	0	1,062	13,246	0	0	0	0	0	**14,308**
x3.y6	0	0	0	0	0	14,025	0	0	0	0	283	**14,308**
x3.y7	0	0	0	283	0	14,025	0	0	0	0	0	**14,308**
x3.y8	0	0	0	0	0	5,100	9,208	0	0	0	0	**14,308**
x3.y9	0	0	0	13,033	0	0	1,275	0	0	0	0	**14,308**
x3.y10	0	0	0	13,398	0	0	910	0	0	0	0	**14,308**
x3.y11	0	0	0	1,275	0	0	13,033	0	0	0	0	**14,308**
x3.y12	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
x3.y13	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x4.y1	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x4.y2	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x4.y3	0	0	0	0	12,750	1,275	0	0	0	0	283	**14,308**
x4.y4	0	0	0	0	0	14,025	0	0	0	0	283	**14,308**
x4.y5	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x4.y6	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x4.y7	0	0	0	0	0	3,580	0	0	0	0	0	**3,580**
x4.y8	0	0	0	0	0	2,550	11,475	283	0	0	0	**14,308**
x4.y9	0	0	0	0	0	0	14,025	0	283	0	0	**14,308**
x4.y10	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x4.y11	0	0	0	0	0	0	14,025	283	0	0	0	**14,308**
x4.y12	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x4.y13	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x5.y1	0	283	0	0	14,025	0	0	0	0	0	0	**14,308**
x5.y2	0	283	0	0	2,550	0	0	11,475	0	0	0	**14,308**
x5.y3	0	283	0	0	2,550	0	0	11,475	0	0	0	**14,308**
x5.y4	0	1,275	0	0	0	0	0	13,033	0	0	0	**14,308**
x5.y5	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y6	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y7	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y8	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y9	0	0	0	0	0	0	0	14,025	283	0	0	**14,308**
x5.y10	0	0	0	0	0	0	0	9,294	5,014	0	0	**14,308**
x5.y11	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x5.y12	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x5.y13	0	0	0	0	0	0	3,825	0	10,483	0	0	**14,308**
x6.y1	0	0	0	0	14,025	0	0	0	0	283	0	**14,308**
x6.y2	0	0	0	283	8,925	0	0	0	0	5,100	0	**14,308**
x6.y3	0	0	0	0	1,275	0	0	0	0	13,033	0	**14,308**
x6.y4	0	0	0	0	0	0	0	0	0	14,025	283	**14,308**
x6.y5	0	1,275	0	0	0	0	0	0	0	13,033	0	**14,308**
x6.y6	1,275	0	0	0	0	1,275	0	0	0	11,758	0	**14,308**
x6.y7	0	0	0	0	0	0	0	7,650	0	6.658	0	**14,308**
x6.y8	1,275	0	0	0	0	0	0	0	0	13,033	0	**14,308**
x6.y9	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y10	493	0	0	0	0	0	0	0	0	13,815	0	**14,308**
x6.y11	0	0	0	0	0	0	0	0	14,025	283	0	**14,308**
x6.y12	620	0	0	0	0	0	0	0	13,688	0	0	**14,308**
x6.y13	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x7.y1	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**

Table B.31. (continued)

	LICENSED DEALER LOCATION											
	x1.y2	x1.y6	x2.y4	x3.y13	x4.y1	x4.y6	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	TOTAL
x7.y2	0	283	0	0	0	0	0	0	0	1,275	12,750	**14,308**
x7.y3	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y4	0	0	0	0	0	0	0	0	0	1,275	13,033	**14,308**
x7.y5	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y6	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	2,480	11,828	**14,308**
x7.y8	1,275	0	0	0	0	0	0	1,275	0	283	11,475	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	2,550	11,758	**14,308**
x7.y10	0	0	0	0	0	0	0	0	0	14,025	283	**14,308**
x7.y11	0	0	0	0	0	0	0	1,275	13,033	0	0	**14,308**
x7.y12	283	0	0	0	0	0	0	0	14,025	0	0	**14,308**
x7.y13	0	283	0	0	0	0	0	0	14,025	0	0	**14,308**
TOTAL	**127,500**	**126,000**	**49,000**	**127,500**	**127,500**	**98,000**	**126,000**	**127,300**	**127,500**	**127,500**	**127,500**	**1,291,300**

Table B.32. Central County: Increased Farmers' Transport Costs - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y2	0	0	126,000	7,000	**133,000**
	x1.y6	0	0	126,000	0	**126,000**
	x2.y4	0	0	49,000	0	**49,000**
	x3.y13	0	133,000	0	0	**133,000**
	x4.y1	126,000	7,000	0	0	**133,000**
	x4.y6	0	0	0	98,000	**98,000**
	x4.y13	0	126,000	0	0	**126,000**
	x5.y7	0	133,000	0	0	**133,000**
	x5.y13	0	133,000	0	0	**133,000**
	x6.y7	0	0	0	133,000	**133,000**
	X7.y6	0	0	0	133,000	**133,000**
TOTAL		**126,000**	**532,000**	**301,000**	**371,000**	**1,330,000**

Table B.33. Central County: Decreased Farmers' Transport Costs - Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION										
		x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	11	0	0	0	0	1	0	0	0	**12**
	x1.y2	0	0	11	0	0	0	0	1	0	0	0	**12**
	x1.y3	11	0	1	0	0	0	0	0	0	0	0	**12**
	x1.y4	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y5	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y6	11	0	0	0	0	0	0	1	0	0	0	**12**
	x1.y7	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y8	11	0	0	0	1	0	0	0	0	0	0	**12**
	x1.y9	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y10	11	0	0	0	1	0	0	0	0	0	0	**12**
	x1.y11	9	0	0	2	1	0	0	0	0	0	0	**12**
	x1.y12	0	0	0	11	1	0	0	0	0	0	0	**12**
	x1.y13	0	0	0	11	1	0	0	0	0	0	0	**12**
	x2.y1	0	0	11	0	0	0	0	1	0	0	0	**12**
	x2.y2	0	0	11	0	0	0	0	1	0	0	0	**12**
	x2.y3	0	0	11	0	0	0	0	1	0	0	0	**12**
	x2.y4	0	11	0	0	0	0	0	1	0	0	0	**12**
	x2.y5	0	11	0	0	0	0	0	1	0	0	0	**12**
	x2.y6	0	11	0	0	0	0	0	1	0	0	0	**12**
	x2.y7	0	12	0	0	0	0	0	0	0	0	0	**12**

Table B.33. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	x7.y7	TOTAL
x2.y8	0	11	0	0	1	0	0	0	0	0	0	**12**
x2.y9	0	11	0	1	0	0	0	0	0	0	0	**12**
x2.y10	0	1	0	10	1	0	0	0	0	0	0	**12**
x2.y11	0	0	0	11	0	0	0	0	0	1	0	**12**
x2.y12	0	0	0	11	0	0	0	0	0	1	0	**12**
x2.y13	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y1	0	0	7	0	5	0	0	0	0	0	0	**12**
x3.y2	0	0	12	0	0	0	0	0	0	0	0	**12**
x3.y3	0	0	12	0	0	0	0	0	0	0	0	**12**
x3.y4	0	0	12	0	0	0	0	0	0	0	0	**12**
x3.y5	0	8	2	0	0	0	1	1	0	0	0	**12**
x3.y6	0	10	0	0	0	0	1	1	0	0	0	**12**
x3.y7	0	12	0	0	0	0	0	0	0	0	0	**12**
x3.y8	0	4	0	0	0	1	1	0	6	0	0	**12**
x3.y9	0	1	0	11	0	0	0	0	0	0	0	**12**
x3.y10	0	0	0	1	0	11	0	0	0	0	0	**12**
x3.y11	0	0	0	1	1	10	0	0	0	0	0	**12**
x3.y12	0	0	0	8	0	4	0	0	0	0	0	**12**
x3.y13	0	0	0	1	0	11	0	0	0	0	0	**12**
x4.y1	0	0	0	0	12	0	0	0	0	0	0	**12**
x4.y2	0	0	0	1	11	0	0	0	0	0	0	**12**
x4.y3	0	0	0	1	11	0	0	0	0	0	0	**12**
x4.y4	0	0	0	1	11	0	0	0	0	0	0	**12**
x4.y5	0	0	0	1	0	0	11	0	0	0	0	**12**
x4.y6	0	0	0	1	0	0	11	0	0	0	0	**12**
x4.y7	0	0	0	0	0	0	3	0	0	0	0	**3**
x4.y8	0	0	1	0	0	7	3	0	1	0	0	**12**
x4.y9	0	0	1	0	0	11	0	0	0	0	0	**12**
x4.y10	0	0	0	0	1	11	0	0	0	0	0	**12**
x4.y11	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y12	1	0	0	0	0	11	0	0	0	0	0	**12**
x4.y13	0	0	0	0	0	12	0	0	0	0	0	**12**
x5.y1	0	0	0	1	11	0	0	0	0	0	0	**12**
x5.y2	0	0	0	1	11	0	0	0	0	0	0	**12**
x5.y3	0	0	0	1	11	0	0	0	0	0	0	**12**
x5.y4	0	0	0	0	0	0	12	0	0	0	0	**12**
x5.y5	0	0	0	1	0	0	11	0	0	0	0	**12**
x5.y6	0	0	0	0	0	0	3	0	9	0	0	**12**
x5.y7	0	0	0	0	0	0	1	0	11	0	0	**12**
x5.y8	0	0	0	0	0	0	11	0	1	0	0	**12**
x5.y9	0	0	1	0	0	0	11	0	0	0	0	**12**
x5.y10	0	0	1	0	0	0	0	11	0	0	0	**12**
x5.y11	0	0	1	0	0	0	0	11	0	0	0	**12**
x5.y12	0	0	1	0	0	0	0	11	0	0	0	**12**
x5.y13	0	0	0	0	0	2	0	10	0	0	0	**12**
x6.y1	0	0	0	1	11	0	0	0	0	0	0	**12**
x6.y2	0	0	0	0	6	0	0	0	4	1	1	**12**
x6.y3	0	0	0	9	0	0	0	0	3	0	0	**12**
x6.y4	0	0	0	0	0	0	0	0	10	1	1	**12**
x6.y5	0	0	0	0	0	0	0	0	10	1	1	**12**
x6.y6	0	0	0	1	0	0	0	0	10	0	1	**12**
x6.y7	0	0	0	0	0	0	0	0	3	0	9	**12**
x6.y8	0	0	1	0	0	0	0	0	10	0	1	**12**
x6.y9	0	0	1	0	0	0	0	0	10	0	1	**12**
x6.y10	0	0	1	0	0	0	0	0	10	0	1	**12**
x6.y11	0	0	1	0	0	0	0	11	0	0	0	**12**
x6.y12	0	0	1	0	0	0	0	11	0	0	0	**12**
x6.y13	0	0	0	0	0	0	0	12	0	0	0	**12**
x7.y1	0	0	0	1	0	0	0	0	0	11	0	**12**
x7.y2	0	0	0	1	0	0	0	0	0	11	0	**12**
x7.y3	0	0	0	1	0	0	0	0	0	11	0	**12**

Table B.33. (continued)

		LICENSED DEALER LOCATION										
		x1.y7	x2.y7	x3.y1	x3.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	x7.y7	TOTAL
	x7.y4	0	0	0	1	0	0	0	0	0	11	0	**12**
	x7.y5	0	0	0	1	0	0	0	0	0	5	6	**12**
	x7.y6	0	0	0	0	0	0	0	0	0	1	11	**12**
	x7.y7	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y8	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y9	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y10	0	0	0	0	0	0	0	0	0	0	12	**12**
	x7.y11	0	0	1	0	0	0	0	0	0	0	11	**12**
	x7.y12	0	0	1	0	0	0	0	1	0	0	10	**12**
	x7.y13	0	0	1	0	0	0	0	8	0	2	1	**12**
TOTAL		**102**	**103**	**115**	**116**	**109**	**103**	**80**	**97**	**98**	**57**	**103**	**1,083**

Table B.34. Central County: Decreased Farmers' Transport Costs - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	0	0	18	0	**18**
	x2.y7	0	0	18	0	**18**
	x3.y1	18	0	0	0	**18**
	x3.y13	0	18	0	0	**18**
	x4.y1	18	0	0	0	**18**
	x4.y13	0	18	0	0	**18**
	x5.y7	0	0	0	14	**14**
	x5.y13	0	17	0	0	**17**
	x6.y7	0	0	0	18	**18**
	x7.y6	0	0	0	10	**10**
	X7.y7	0	0	0	18	**18**
TOTAL		**36**	**53**	**36**	**60**	**185**

Table B.35. Central County: Decreased Farmers' Transport Costs - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION										
		x1.y7	x2.y7	x4.y1	x4.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	13,033	0	0	0	0	1,275	0	0	0	**14,308**
	x1.y2	0	0	13,033	0	0	0	0	1,275	0	0	0	**14,308**
	x1.y3	14,025	0	283	0	0	0	0	0	0	0	0	**14,308**
	x1.y4	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y5	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y6	14,025	0	0	0	0	0	0	283	0	0	0	**14,308**
	x1.y7	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	14,025	0	0	0	283	0	0	0	0	0	0	**14,308**
	x1.y9	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y10	14,025	0	0	0	283	0	0	0	0	0	0	**14,308**
	x1.y11	11,475	0	0	2,550	283	0	0	0	0	0	0	**14,308**
	x1.y12	0	0	0	13,033	1,275	0	0	0	0	0	0	**14,308**
	x1.y13	0	0	0	13,033	1,275	0	0	0	0	0	0	**14,308**
	x2.y1	0	0	13,033	0	0	0	0	1,275	0	0	0	**14,308**
	x2.y2	0	0	13,033	0	0	0	0	1,275	0	0	0	**14,308**
	x2.y3	0	0	13,033	0	0	0	0	1,275	0	0	0	**14,308**
	x2.y4	0	13,033	0	0	0	0	0	1,275	0	0	0	**14,308**
	x2.y5	0	14,025	0	0	0	0	0	283	0	0	0	**14,308**
	x2.y6	0	13,033	0	0	0	0	0	1,275	0	0	0	**14,308**
	x2.y7	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y8	0	14,025	0	0	283	0	0	0	0	0	0	**14,308**
	x2.y9	0	14,025	0	283	0	0	0	0	0	0	0	**14,308**
	x2.y10	0	1,275	0	11,758	1,275	0	0	0	0	0	0	**14,308**
	x2.y11	0	0	0	13,033	0	0	0	0	0	1,275	0	**14,308**
	x2.y12	0	0	0	13,033	0	0	0	0	0	1,275	0	**14,308**
	x2.y13	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y1	0	0	8,925	0	5,383	0	0	0	0	0	0	**14,308**

Table B.35. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	x2.y7	x4.y1	x4.y13	x4.y1	x4.y13	x5.y7	x5.y13	x6.y7	x7.y6	x7.y7	TOTAL
x3.y2	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
x3.y3	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
x3.y4	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
x3.y5	0	10,200	1,558	0	0	0	1,275	1,275	0	0	0	**14,308**
x3.y6	0	12,385	0	0	0	0	1,275	648	0	0	0	**14,308**
x3.y7	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
x3.y8	0	4,108	0	0	0	1,275	1,275	0	7,650	0	0	**14,308**
x3.y9	0	1,275	0	13,033	0	0	0	0	0	0	0	**14,308**
x3.y10	0	0	0	1,120	0	13,188	0	0	0	0	0	**14,308**
x3.y11	0	0	0	1,275	283	12,750	0	0	0	0	0	**14,308**
x3.y12	0	0	0	9,208	0	5,100	0	0	0	0	0	**14,308**
x3.y13	0	0	0	283	0	14,025	0	0	0	0	0	**14,308**
x4.y1	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
x4.y2	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
x4.y3	0	0	0	362	13,946	0	0	0	0	0	0	**14,308**
x4.y4	0	0	0	283	14,025	0	0	0	0	0	0	**14,308**
x4.y5	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x4.y6	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x4.y7	0	0	0	0	0	0	3,580	0	0	0	0	**3,580**
x4.y8	0	0	803	0	0	8,405	3,825	0	1,275	0	0	**14,308**
x4.y9	0	0	1,275	0	0	13,033	0	0	0	0	0	**14,308**
x4.y10	0	0	0	0	283	14,025	0	0	0	0	0	**14,308**
x4.y11	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x4.y12	283	0	0	0	0	14,025	0	0	0	0	0	**14,308**
x4.y13	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x5.y1	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
x5.y2	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
x5.y3	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
x5.y4	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x5.y5	0	0	0	283	0	0	14,025	0	0	0	0	**14,308**
x5.y6	0	0	0	0	0	0	2,833	0	11,475	0	0	**14,308**
x5.y7	0	0	0	0	0	0	283	0	14,025	0	0	**14,308**
x5.y8	0	0	0	0	0	0	13,033	0	1,275	0	0	**14,308**
x5.y9	0	0	283	0	0	0	14,025	0	0	0	0	**14,308**
x5.y10	0	0	283	0	0	0	0	14,025	0	0	0	**14,308**
x5.y11	0	0	283	0	0	0	0	14,025	0	0	0	**14,308**
x5.y12	0	0	363	0	0	0	0	13,945	0	0	0	**14,308**
x5.y13	0	0	0	0	0	1,558	0	12,750	0	0	0	**14,308**
x6.y1	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
x6.y2	0	0	0	0	7,650	0	0	0	5,100	283	1,275	**14,308**
x6.y3	0	0	0	10,483	0	0	0	0	3,825	0	0	**14,308**
x6.y4	0	0	0	0	0	0	0	0	12,750	1,275	283	**14,308**
x6.y5	0	0	0	0	0	0	0	0	12,750	283	1,275	**14,308**
x6.y6	0	0	0	283	0	0	0	0	12,750	0	1,275	**14,308**
x6.y7	0	0	0	0	0	0	0	0	3,825	0	10,483	**14,308**
x6.y8	0	0	283	0	0	0	0	0	12,750	0	1,275	**14,308**
x6.y9	0	0	283	0	0	0	0	0	12,750	0	1,275	**14,308**
x6.y10	0	0	283	0	0	0	0	0	12,750	0	1,275	**14,308**
x6.y11	0	0	1,275	0	0	0	0	13,033	0	0	0	**14,308**
x6.y12	0	0	283	0	0	0	0	14,025	0	0	0	**14,308**
x6.y13	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x7.y1	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x7.y2	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x7.y3	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x7.y4	0	0	0	283	0	0	0	0	0	14,025	0	**14,308**
x7.y5	0	0	0	283	0	0	0	0	0	6,375	7,650	**14,308**
x7.y6	0	0	0	0	0	0	0	0	0	584	13,724	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y8	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y10	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y11	0	0	283	0	0	0	0	0	0	0	14,025	**14,308**
x7.y12	0	0	283	0	0	0	0	1,275	0	0	12,750	**14,308**
x7.y13	0	0	283	0	0	0	0	10,200	0	2,550	1,275	**14,308**
TOTAL	**125,090**	**126,000**	**125,401**	**126,000**	**126,000**	**126,000**	**97,787**	**119,000**	**124,950**	**70,000**	**125,072**	**1,291,300**

Table B.36. Central County: Decreased Farmers' Transport Costs - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	0	0	126,000	0	**126,000**
	x2.y7	0	0	126,000	0	**126,000**
	x3.y1	126,000	0	0	0	**126,000**
	x3.y13	0	126,000	0	0	**126,000**
	x4.y1	126,000	0	0	0	**126,000**
	x4.y13	0	126,000	0	0	**126,000**
	x5.y7	0	0	0	98,000	**98,000**
	x5.y13	0	119,000	0	0	**119,000**
	x6.y7	0	0	0	126,000	**126,000**
	x7.y6	0	0	0	70,000	**70,000**
	X7.y7	0	0	0	126,000	**126,000**
TOTAL		**252,000**	**371,000**	**252,000**	**420,000**	**1,295,000**

Table B.37. Central County: Social Cost Doubled - Number of Trips from Farm to Licensed Dealer

		LICENSED DEALER LOCATION											
		x1.y7	x2.y7	x3.y13	x4.y1	x4.y2	x4.y3	x4.y13	x5.y7	x5.y13	x6.y3	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	11	0	0	0	0	1	0	0	**12**
	x1.y2	1	0	0	11	0	0	0	0	0	0	0	**12**
	x1.y3	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y4	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y5	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y6	11	0	0	0	0	0	0	0	1	0	0	**12**
	x1.y7	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y8	11	0	0	1	0	0	0	0	0	0	0	**12**
	x1.y9	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y10	12	0	0	0	0	0	0	0	0	0	0	**12**
	x1.y11	7	0	5	0	0	0	0	0	0	0	0	**12**
	x1.y12	0	0	12	0	0	0	0	0	0	0	0	**12**
	x1.y13	0	0	12	0	0	0	0	0	0	0	0	**12**
	x2.y1	0	0	0	11	0	0	0	0	1	0	0	**12**
	x2.y2	0	0	0	12	0	0	0	0	0	0	0	**12**
	x2.y3	0	0	0	0	0	12	0	0	0	0	0	**12**
	x2.y4	0	3	0	0	0	9	0	0	0	0	0	**12**
	x2.y5	1	11	0	0	0	0	0	0	0	0	0	**12**
	x2.y6	1	11	0	0	0	0	0	0	0	0	0	**12**
	x2.y7	0	12	0	0	0	0	0	0	0	0	0	**12**
	x2.y8	0	12	0	0	0	0	0	0	0	0	0	**12**
	x2.y9	0	11	0	0	0	0	0	0	0	0	1	**12**
	x2.y10	0	10	2	0	0	0	0	0	0	0	0	**12**
	x2.y11	0	0	12	0	0	0	0	0	0	0	0	**12**
	x2.y12	0	0	12	0	0	0	0	0	0	0	0	**12**
	x2.y13	0	0	12	0	0	0	0	0	0	0	0	**12**
	x3.y1	0	0	0	12	0	0	0	0	0	0	0	**12**
	x3.y2	0	0	0	1	11	0	0	0	0	0	0	**12**
	x3.y3	0	0	0	0	0	12	0	0	0	0	0	**12**
	x3.y4	0	0	0	0	0	12	0	0	0	0	0	**12**
	x3.y5	0	0	0	0	0	12	0	0	0	0	0	**12**
	x3.y6	0	12	0	0	0	0	0	0	0	0	0	**12**
	x3.y7	0	12	0	0	0	0	0	0	0	0	0	**12**
	x3.y8	0	12	0	0	0	0	0	0	0	0	0	**12**
	x3.y9	0	1	11	0	0	0	0	0	0	0	0	**12**
	x3.y10	0	0	5	0	0	0	7	0	0	0	0	**12**
	x3.y11	0	0	12	0	0	0	0	0	0	0	0	**12**

Table B.37. (continued)

	LICENSED DEALER LOCATION											
	x1.y7	**x2.y7**	**x3.y13**	**x4.y1**	**x4.y2**	**x4.y3**	**x4.y13**	**x5.y7**	**x5.y13**	**x6.y3**	**x7.y7**	**TOTAL**
x3.y12	0	0	12	0	0	0	0	0	0	0	0	**12**
x3.y13	0	0	1	0	0	0	11	0	0	0	0	**12**
x4.y1	0	0	0	12	0	0	0	0	0	0	0	**12**
x4.y2	0	0	0	6	6	0	0	0	0	0	0	**12**
x4.y3	0	0	0	5	0	7	0	0	0	0	0	**12**
x4.y4	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y5	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y6	0	0	0	0	0	0	0	10	0	2	0	**12**
x4.y7	0	0	0	0	0	0	0	3	0	0	0	**3**
x4.y8	0	0	0	0	0	0	0	11	0	1	0	**12**
x4.y9	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y10	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y11	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y12	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y13	0	0	0	0	0	0	12	0	0	0	0	**12**
x5.y1	0	0	0	12	0	0	0	0	0	0	0	**12**
x5.y2	0	0	0	0	0	12	0	0	0	0	0	**12**
x5.y3	0	0	0	0	0	5	0	0	0	7	0	**12**
x5.y4	0	0	0	0	0	0	0	0	0	12	0	**12**
x5.y5	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y6	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y7	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y8	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y9	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y10	0	0	0	0	0	0	0	0	12	0	0	**12**
x5.y11	0	0	0	0	0	0	4	0	8	0	0	**12**
x5.y12	0	0	0	0	0	0	0	0	12	0	0	**12**
x5.y13	0	0	0	0	0	0	11	0	1	0	0	**12**
x6.y1	0	0	0	11	0	0	0	0	0	1	0	**12**
x6.y2	0	0	0	0	0	0	0	0	0	12	0	**12**
x6.y3	1	0	0	0	0	0	0	0	0	11	0	**12**
x6.y4	0	0	0	0	0	0	0	0	0	12	0	**12**
x6.y5	0	0	0	0	0	0	12	0	0	0	0	**12**
x6.y6	0	0	0	0	0	0	0	12	0	0	0	**12**
x6.y7	1	0	0	0	0	0	0	0	0	0	11	**12**
x6.y8	1	0	0	0	0	0	0	11	0	0	0	**12**
x6.y9	0	0	0	0	0	0	0	0	1	0	11	**12**
x6.y10	0	0	0	0	0	0	0	0	12	0	0	**12**
x6.y11	0	0	0	0	0	0	0	0	12	0	0	**12**
x6.y12	0	0	0	0	0	0	0	0	12	0	0	**12**
x6.y13	0	0	0	0	0	0	0	0	12	0	0	**12**
x7.y1	0	0	0	0	0	0	0	0	0	12	0	**12**
x7.y2	0	0	0	0	0	0	0	0	0	12	0	**12**
x7.y3	1	0	0	0	0	0	0	0	0	11	0	**12**
x7.y4	0	0	0	0	0	0	0	0	0	12	0	**12**
x7.y5	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y6	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y7	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y8	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y9	0	0	0	0	0	0	0	0	0	0	12	**12**
x7.y10	1	0	0	0	0	0	0	0	0	0	11	**12**
x7.y11	0	0	0	0	0	0	0	0	0	1	11	**12**
x7.y12	0	0	0	0	0	0	0	0	12	0	0	**12**
x7.y13	0	0	0	0	0	0	0	0	12	0	0	**12**
TOTAL	**109**	**107**	**108**	**105**	**17**	**105**	**105**	**107**	**109**	**106**	**105**	**1,083**

Table B.38. Central County: Social Cost Doubled - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	0	0	18	0	**18**
	x2.y7	0	0	18	0	**18**
	x3.y13	0	19	0	0	**19**
	x4.y1	19	0	0	0	**19**
	x4.y2	0	3	0	0	**3**
	x4.y3	18	0	0	0	**18**
	x4.y13	0	19	0	0	**19**
	x5.y7	0	0	0	19	**19**
	x5.y13	0	19	0	0	**19**
	x6.y3	19	0	0	0	**19**
	x7.y7	0	0	0	19	**19**
TOTAL		**56**	**60**	**36**	**38**	**190**

Table B.39. Central County: Social Cost Doubled - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION											
		x1.y7	x2.y7	x3.y13	x4.y1	x4.y2	x4.y3	x4.y13	x5.y7	x5.y13	x6.y3	x7.y7	TOTAL
FARM LOCATION	x1.y1	0	0	0	14,025	0	0	0	0	283	0	0	**14,308**
	x1.y2	283	0	0	14,025	0	0	0	0	0	0	0	**14,308**
	x1.y3	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y4	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y5	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y6	13,033	0	0	0	0	0	0	0	1,275	0	0	**14,308**
	x1.y7	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	13,033	0	0	1,275	0	0	0	0	0	0	0	**14,308**
	x1.y9	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y10	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y11	8,925	0	5,383	0	0	0	0	0	0	0	0	**14,308**
	x1.y12	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x1.y13	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x2.y1	0	0	0	13,074	0	0	0	0	1,234	0	0	**14,308**
	x2.y2	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y3	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x2.y4	0	2,833	0	0	0	11,475	0	0	0	0	0	**14,308**
	x2.y5	1,068	13,240	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y6	1,275	13,033	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y7	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y8	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y9	0	13,033	0	0	0	0	0	0	0	0	1,275	**14,308**
	x2.y10	0	12,038	2,270	0	0	0	0	0	0	0	0	**14,308**
	x2.y11	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x2.y12	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x2.y13	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x3.y1	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y2	0	0	0	283	14,025	0	0	0	0	0	0	**14,308**
	x3.y3	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x3.y4	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x3.y5	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x3.y6	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x3.y7	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x3.y8	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x3.y9	0	283	14,025	0	0	0	0	0	0	0	0	**14,308**
	x3.y10	0	0	5,383	0	0	0	8,925	0	0	0	0	**14,308**
	x3.y11	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x3.y12	0	0	14,308	0	0	0	0	0	0	0	0	**14,308**
	x3.y13	0	0	283	0	0	0	14,025	0	0	0	0	**14,308**
	x4.y1	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x4.y2	0	0	0	7,333	6,975	0	0	0	0	0	0	**14,308**
	x4.y3	0	0	0	6,375	0	7,933	0	0	0	0	0	**14,308**
	x4.y4	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y5	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y6	0	0	0	0	0	0	0	11,758	0	2,550	0	**14,308**
	x4.y7	0	0	0	0	0	0	0	3,580	0	0	0	**3,580**
	x4.y8	0	0	0	0	0	0	0	13,033	0	1,275	0	**14,308**
	x4.y9	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y10	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y11	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y12	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**

Table B.39. (continued)

	LICENSED DEALER LOCATION										
	x1.y7	x2.y7	x3.y13	x4.y1	x4.y2	x4.y3	x4.y13	x5.y7	x5.y13	x6.y3	x7.y7	TOTAL
x4.y13	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x5.y1	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
x5.y2	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
x5.y3	0	0	0	0	0	6,236	0	0	0	8,072	0	**14,308**
x5.y4	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x5.y5	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y6	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y7	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y8	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y9	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x5.y10	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x5.y11	0	0	0	0	0	0	4,677	0	9,631	0	0	**14,308**
x5.y12	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x5.y13	0	0	0	0	0	0	14,025	0	283	0	0	**14,308**
x6.y1	0	0	0	13,878	0	0	0	0	0	430	0	**14,308**
x6.y2	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y3	283	0	0	0	0	0	0	0	0	14,025	0	**14,308**
x6.y4	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x6.y5	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
x6.y6	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
x6.y7	659	0	0	0	0	0	0	0	0	0	13,649	**14,308**
x6.y8	1,027	0	0	0	0	0	0	13,281	0	0	0	**14,308**
x6.y9	0	0	0	0	0	0	0	0	330	0	13,978	**14,308**
x6.y10	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x6.y11	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x6.y12	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x6.y13	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x7.y1	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y2	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y3	283	0	0	0	0	0	0	0	0	14,025	0	**14,308**
x7.y4	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
x7.y5	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y6	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y7	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y8	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y9	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
x7.y10	283	0	0	0	0	0	0	0	0	0	14,025	**14,308**
x7.y11	0	0	0	0	0	0	0	0	0	1,275	13,033	**14,308**
x7.y12	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
x7.y13	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
TOTAL	**126,000**	**126,000**	**127,500**	**127,500**	**21,000**	**125,800**	**127,500**	**127,500**	**127,500**	**127,500**	**127,500**	**1,291,300**

Table B.40. Central County: Social Cost Doubled - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y7	0	0	126,000	0	**126,000**
	x2.y7	0	0	126,000	0	**126,000**
	x3.y13	0	133,000	0	0	**133,000**
	x4.y1	133,000	0	0	0	**133,000**
	x4.y2	0	21,000	0	0	**21,000**
	x4.y3	126,000	0	0	0	**126,000**
	x4.y13	0	133,000	0	0	**133,000**
	x5.y7	0	0	0	133,000	**133,000**
	x5.y13	0	133,000	0	0	**133,000**
	x6.y3	133,000	0	0	0	**133,000**
	x7.y7	0	0	0	133,000	**133,000**
TOTAL		**392,000**	**420,000**	**252,000**	**266,000**	**1,330,000**

Table B.41. Central County: No Social Cost - Number of Trips from Farm to Licensed Dealer

	LICENSED DEALER LOCATION											
FARM LOCATION	x1.y6	x1.y7	x1.y8	x2.y7	x3.y13	x4.y1	x4.y13	x5.y13	x6.y7	x7.y7	x7.y8	TOTAL
x1.y1	0	12	0	0	0	0	0	0	0	0	0	**12**
x1.y2	0	12	0	0	0	0	0	0	0	0	0	**12**
x1.y3	0	12	0	0	0	0	0	0	0	0	0	**12**
x1.y4	0	12	0	0	0	0	0	0	0	0	0	**12**
x1.y5	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y6	0	12	0	0	0	0	0	0	0	0	0	**12**
x1.y7	11	1	0	0	0	0	0	0	0	0	0	**12**
x1.y8	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y9	10	0	2	0	0	0	0	0	0	0	0	**12**
x1.y10	11	1	0	0	0	0	0	0	0	0	0	**12**
x1.y11	0	10	2	0	0	0	0	0	0	0	0	**12**
x1.y12	12	0	0	0	0	0	0	0	0	0	0	**12**
x1.y13	12	0	0	0	0	0	0	0	0	0	0	**12**
x2.y1	0	11	0	1	0	0	0	0	0	0	0	**12**
x2.y2	11	0	0	1	0	0	0	0	0	0	0	**12**
x2.y3	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y4	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y5	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y6	11	0	0	1	0	0	0	0	0	0	0	**12**
x2.y7	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y8	0	1	11	0	0	0	0	0	0	0	0	**12**
x2.y9	1	0	0	11	0	0	0	0	0	0	0	**12**
x2.y10	0	11	0	1	0	0	0	0	0	0	0	**12**
x2.y11	0	11	0	1	0	0	0	0	0	0	0	**12**
x2.y12	0	0	0	12	0	0	0	0	0	0	0	**12**
x2.y13	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y1	0	0	0	0	11	0	1	0	0	0	0	**12**
x3.y2	0	0	0	0	12	0	0	0	0	0	0	**12**
x3.y3	0	0	0	0	12	0	0	0	0	0	0	**12**
x3.y4	0	0	0	0	7	0	5	0	0	0	0	**12**
x3.y5	0	0	0	0	12	0	0	0	0	0	0	**12**
x3.y6	0	0	0	12	0	0	0	0	0	0	0	**12**
x3.y7	0	0	0	0	0	12	0	0	0	0	0	**12**
x3.y8	0	0	0	4	1	7	0	0	0	0	0	**12**
x3.y9	0	0	0	0	12	0	0	0	0	0	0	**12**
x3.y10	0	0	0	5	7	0	0	0	0	0	0	**12**
x3.y11	0	0	0	0	12	0	0	0	0	0	0	**12**
x3.y12	0	0	0	1	11	0	0	0	0	0	0	**12**
x3.y13	0	0	0	0	11	1	0	0	0	0	0	**12**
x4.y1	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y2	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y3	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y4	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y5	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y6	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y7	0	0	0	0	0	3	0	0	0	0	0	**3**
x4.y8	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y9	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y10	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y11	0	0	0	0	0	0	12	0	0	0	0	**12**
x4.y12	0	0	0	0	0	12	0	0	0	0	0	**12**
x4.y13	0	0	0	0	0	0	12	0	0	0	0	**12**
x5.y1	0	0	0	0	0	0	5	7	0	0	0	**12**
x5.y2	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y3	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y4	0	0	0	0	0	11	0	1	0	0	0	**12**
x5.y5	0	0	0	0	0	12	0	0	0	0	0	**12**
x5.y6	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y7	0	0	0	0	0	0	0	12	0	0	0	**12**
x5.y8	0	0	0	0	0	0	0	4	8	0	0	**12**

Table B.41. (continued)

	LICENSED DEALER LOCATION											
	x1.y6	x1.y7	x1.y8	x2.y7	x3.y13	x4.y1	x4.y13	x5.y13	x6.y7	x7.y7	x7.y8	TOTAL
x5.y9	0	0	0	0	0	0	0	12	0	0	0	12
x5.y10	0	0	0	0	0	11	0	0	1	0	0	12
x5.y11	0	0	0	0	0	0	0	12	0	0	0	12
x5.y12	0	0	0	0	0	0	0	12	0	0	0	12
x5.y13	0	0	0	0	0	0	0	12	0	0	0	12
x6.y1	0	0	0	0	0	0	0	0	2	10	0	12
x6.y2	0	0	0	0	0	0	0	0	1	0	11	12
x6.y3	0	0	0	0	0	0	0	0	12	0	0	12
x6.y4	0	0	0	0	0	0	0	0	12	0	0	12
x6.y5	0	0	0	0	0	0	0	0	1	11	0	12
x6.y6	0	0	0	0	0	0	0	0	12	0	0	12
x6.y7	0	0	0	0	0	0	0	0	12	0	0	12
x6.y8	0	0	0	0	0	0	0	0	12	0	0	12
x6.y9	0	0	0	0	0	0	0	0	12	0	0	12
x6.y10	0	0	0	0	0	0	0	0	1	0	11	12
x6.y11	0	0	0	0	0	0	0	0	1	11	0	12
x6.y12	0	0	0	0	0	0	0	0	12	0	0	12
x6.y13	0	0	0	0	0	0	0	0	12	0	0	12
x7.y1	0	0	0	0	0	0	0	0	0	12	0	12
x7.y2	0	0	0	0	0	0	0	0	0	2	10	12
x7.y3	0	0	0	0	0	0	0	0	0	0	12	12
x7.y4	0	0	0	0	0	0	0	0	0	0	12	12
x7.y5	0	0	0	0	0	0	0	0	0	0	12	12
x7.y6	0	0	0	0	0	0	0	0	0	11	1	12
x7.y7	0	0	0	0	0	0	0	0	0	0	12	12
x7.y8	0	0	0	0	0	0	0	0	0	11	1	12
x7.y9	0	0	0	0	0	0	0	0	0	12	0	12
x7.y10	0	0	0	0	0	0	0	0	0	12	0	12
x7.y11	0	0	0	0	0	0	0	0	0	0	12	12
x7.y12	0	0	0	0	0	0	0	0	0	0	12	12
x7.y13	0	0	0	0	0	0	0	0	0	12	0	12
TOTAL	103	106	15	110	108	105	107	108	111	104	106	1,083

Table B.42. Central County: No Social Cost - Number of Trips from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y6	0	0	19	0	19
	x1.y7	0	0	19	0	19
	x1.y8	0	0	3	0	3
	x2.y7	0	0	19	0	19
	x3.y13	0	19	0	0	19
	x4.y1	19	0	0	0	19
	x4.y13	0	19	0	0	19
	x5.y13	0	19	0	0	19
	x6.y7	0	0	0	19	19
	x7.y7	0	0	0	19	19
	x7.y8	0	0	0	19	19
TOTAL		19	57	60	57	193

Table B.43. Central County: No Social Cost - Gallons of Anhydrous Ammonia from Licensed Dealer to Farm

		LICENSED DEALER LOCATION											
		x1.y6	x1.y7	x1.y8	x2.y7	x3.y13	x4.y1	x4.y13	x5.y13	x6.y7	x7.y7	x7.y8	TOTAL
FARM LOCATION	x1.y1	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y2	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y3	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y4	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y5	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y6	0	14,308	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y7	14,025	283	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y8	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y9	11,758	0	2,550	0	0	0	0	0	0	0	0	**14,308**
	x1.y10	14,025	283	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y11	0	11,758	2,550	0	0	0	0	0	0	0	0	**14,308**
	x1.y12	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x1.y13	14,308	0	0	0	0	0	0	0	0	0	0	**14,308**
	x2.y1	0	14,025	0	283	0	0	0	0	0	0	0	**14,308**
	x2.y2	14,025	0	0	283	0	0	0	0	0	0	0	**14,308**
	x2.y3	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y4	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y5	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y6	14,025	0	0	283	0	0	0	0	0	0	0	**14,308**
	x2.y7	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y8	0	283	14,025	0	0	0	0	0	0	0	0	**14,308**
	x2.y9	1,275	0	0	13,033	0	0	0	0	0	0	0	**14,308**
	x2.y10	0	14,025	0	283	0	0	0	0	0	0	0	**14,308**
	x2.y11	0	14,025	0	283	0	0	0	0	0	0	0	**14,308**
	x2.y12	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x2.y13	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y1	0	0	0	0	13,745	0	563	0	0	0	0	**14,308**
	x3.y2	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y3	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y4	0	0	0	0	7,933	0	6,375	0	0	0	0	**14,308**
	x3.y5	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y6	0	0	0	14,308	0	0	0	0	0	0	0	**14,308**
	x3.y7	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x3.y8	0	0	0	5,100	283	8,925	0	0	0	0	0	**14,308**
	x3.y9	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y10	0	0	0	6,375	7,933	0	0	0	0	0	0	**14,308**
	x3.y11	0	0	0	0	14,308	0	0	0	0	0	0	**14,308**
	x3.y12	0	0	0	1,275	13,033	0	0	0	0	0	0	**14,308**
	x3.y13	0	0	0	0	13,033	1,275	0	0	0	0	0	**14,308**
	x4.y1	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y2	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y3	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y4	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y5	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y6	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y7	0	0	0	0	0	3,580	0	0	0	0	0	**3,580**
	x4.y8	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y9	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y10	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y11	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x4.y12	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x4.y13	0	0	0	0	0	0	14,308	0	0	0	0	**14,308**
	x5.y1	0	0	0	0	0	0	6,098	8,210	0	0	0	**14,308**
	x5.y2	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y3	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y4	0	0	0	0	0	14,025	0	283	0	0	0	**14,308**
	x5.y5	0	0	0	0	0	14,308	0	0	0	0	0	**14,308**
	x5.y6	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y7	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y8	0	0	0	0	0	0	0	4,543	9,765	0	0	**14,308**
	x5.y9	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y10	0	0	0	0	0	13,847	0	0	461	0	0	**14,308**
	x5.y11	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y12	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x5.y13	0	0	0	0	0	0	0	14,308	0	0	0	**14,308**
	x6.y1	0	0	0	0	0	0	0	0	1,558	12,750	0	**14,308**
	x6.y2	0	0	0	0	0	0	0	0	283	0	14,025	**14,308**
	x6.y3	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y4	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y5	0	0	0	0	0	0	0	0	283	14,025	0	**14,308**
	x6.y6	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y7	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y8	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y9	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y10	0	0	0	0	0	0	0	0	283	0	14,025	**14,308**
	x6.y11	0	0	0	0	0	0	0	0	403	13,905	0	**14,308**
	x6.y12	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x6.y13	0	0	0	0	0	0	0	0	14,308	0	0	**14,308**
	x7.y1	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**

Table B.43. (continued)

		LICENSED DEALER LOCATION											
		x1.y6	x1.y7	x1.y8	x2.y7	x3.y13	x4.y1	x4.y13	x5.y13	x6.y7	x7.y7	x7.y8	TOTAL
	x7.y2	0	0	0	0	0	0	0	0	0	1,558	12,750	**14,308**
	x7.y3	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
	x7.y4	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
	x7.y5	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
	x7.y6	0	0	0	0	0	0	0	0	0	14,005	303	**14,308**
	x7.y7	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
	x7.y8	0	0	0	0	0	0	0	0	0	14,025	283	**14,308**
	x7.y9	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
	x7.y10	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
	x7.y11	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
	x7.y12	0	0	0	0	0	0	0	0	0	0	14,308	**14,308**
	x7.y13	0	0	0	0	0	0	0	0	0	14,308	0	**14,308**
TOTAL		**126,365**	**126,222**	**19,125**	**127,354**	**127,500**	**127,500**	**127,500**	**127,500**	**127,500**	**127,500**	**127,234**	**1,291,300**

Table B.44. Central County: No Social Cost - Gallons of Anhydrous Ammonia from Manufacturer Entrance to Licensed Dealer Location

		MANUFACTURER LOCATION				
		m1	m2	m3	m4	TOTAL
LICENSED DEALER LOCATION	x1.y6	0	0	133,000	0	**133,000**
	x1.y7	0	0	133,000	0	**133,000**
	x1.y8	0	0	21,000	0	**21,000**
	x2.y7	0	0	133,000	0	**133,000**
	x3.y13	0	133,000	0	0	**133,000**
	x4.y1	133,000	0	0	0	**133,000**
	x4.y13	0	133,000	0	0	**133,000**
	x5.y13	0	133,000	0	0	**133,000**
	x6.y7	0	0	0	133,000	**133,000**
	x7.y7	0	0	0	133,000	**133,000**
	x7.y8	0	0	0	133,000	**133,000**
TOTAL		**133,000**	**399,000**	**420,000**	**399,000**	**1,351,000**

APPENDIX C

This program computes the expected net social cost of transporting and delivering anhydrous ammonia to a representative ND county.


```
OPTION limrow=0; OPTION limcol=0;

SETS
xgrid xcoordinates /x1*x7/
ygrid ycoordinates /y1*y13/
manu  manufacturers /m1*m4/
road  /rural,urban/
county /west,central,east/
;
ALIAS (xgrid,xg1,xg2);
ALIAS (ygrid,yg1,yg2);

PARAMETERS
fixed fixed costs for distribution points
afcost probability wieghted cost per mile of accident for farm
rfcost probability weighted cost of inj from release for farm PER MILE
adcost probability weighted cost per mile of accident for distributors
rdcost probability weighted cost of inj from release for distributors PER MILE
miles(road) percent road that is rural versus urban
pop(road) population by rural and urban per sq mile
/rural  48
urban  4383/
fertdemand(xg1,yg1) fertilizer demand by node in gallons
dist(xg1,yg1,xg1,yg1) distance between nodes
w(manu,xg1,yg1) distance from manufactures to xg1  yg1
;
SCALARS
transd transportation cost per mile per ton manu to dist /3.45/
transf transportation cost per mile per gallon dist to farm /1.3864/
;
*need to fix these demands
fertdemand(xg1,yg1) = 15675;
*grid square 1,1 is urban. can change location.
fertdemand('x4','y7')= 3922;

miles('rural') = .95;
miles('urban') = 1-miles('rural');
dist(xg1,yg1,xg2,yg2)= ABS(ORD(xg1)-ORD(xg2))*4 + ABS(ORD(yg1)-ORD(yg2))*4
;
```

```
w('m1',xg1,yg1) = ABS(ORD(xg1)-4)*4 + (ORD(yg1)+1)*4;
w('m2',xg1,yg1) = ABS(ORD(xg1)-4)*4 + ABS((ORD(yg1)-14))*4;
w('m3',xg1,yg1) = ABS(ORD(xg1)+1)*4 + ABS((ORD(yg1)-7))*4;
w('m4',xg1,yg1) = ABS(ORD(xg1)-8)*4 + ABS((ORD(yg1)-7))*4;
fixed = 872500;
afcost = 2.135567784*0.001399515/1000000 *(1160000*0.015267176
        + 938482*0.229007634 + 5703.312977);
adcost = 2.703575358*0.001399515/1000000 *(1160000*0.015267176
        + 938482*0.229007634 + 5703.312977);
rfcost = 0.11605003 * 2.135567784*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);
rdcost = 0.41598848 *2.703575358*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);

INTEGER VARIABLES
a(xgrid,ygrid) distributor location
b(xg1,yg1,xg1,yg1) number of trips by farm to dist
c(manu,xg1,yg1) number of trips by dist to manu
;

VARIABLES
quant(xg1,yg1,xg1,yg1) quantity of fert by farm from dist
sold(manu,xg1,yg1) quantity of fertilizer sold at location xg1 yg1
totcost
;

EQUATIONS
obj objective function
demand(xg1,yg1) demand constraint
distlim(xg1,yg1) distribution contraint
manutodist(xg1,yg1)
mina(xg1,yg1)
ftrips(xg1,yg1,xg2,yg2) number of trips by farm to dist 1275 ga per trip lim
dtrips(manu,xg1,yg1) number of trips by dist to manu 9000 ga per trip lim
;

a.lo(xg1,yg1) = 0;
a.up(xg1,yg1) = 1;
b.lo(xg1,yg1,xg2,yg2) = 0;
c.lo(manu,xg1,yg1) =0;
quant.lo(xg1,yg1,xg2,yg2)=0;
sold.lo(manu,xg1,yg1)=0;
obj.. SUM((xg1,yg1,xg2,yg2),dist(xg1,yg2,xg2,yg2)*transf*b(xg1,yg1,xg2,yg2 ))
     +SUM((manu,xg1,yg1),w(manu,xg1,yg1)*transd*c(manu,xg1,yg1))
     +SUM((xg1,yg1,xg2,yg2),(afcost+rfcost)*dist(xg1,yg1,xg2,yg2)*
                    b(xg1,yg1,xg2,yg2))
```

```
      +SUM((manu,xg1,yg1),(adcost+rdcost)*w(manu,xg1,yg1)*c(manu,xg1,yg1))
      +SUM((xg1,yg1),fixed*a(xg1,yg1))
  =E= totcost;
demand(xg1,yg1).. SUM((xg2,yg2),quant(xg1,yg1,xg2,yg2)) =G= fertdemand(xg1,yg1);
distlim(xg2,yg2).. SUM((xg1,yg1),quant(xg1,yg1,xg2,yg2)) =L= 75000*2.5;
manutodist(xg1,yg1).. SUM(manu,sold(manu,xg1,yg1)) =G=
                  SUM((xg2,yg2),quant(xg2,yg2,xg1,yg1));
mina(xg2,yg2)..  SUM((xg1,yg1),quant(xg1,yg1,xg2,yg2)) =L= a(xg2,yg2)*5100
     0*2.5;
ftrips(xg1,yg1,xg2,yg2).. b(xg1,yg1,xg2,yg2) =G= quant(xg1,yg1,xg2,yg2)/12
     75;
dtrips(manu,xg1,yg1).. c(manu,xg1,yg1) =G= sold(manu,xg1,yg1)/7000;
LOOP((xg1,yg1,xg2,yg2)$(dist(xg1,yg1,xg2,yg2) EQ 0),
dist(xg1,yg1,xg2,yg2) = 2;
 );
a.l(xg1,yg1) = 1;
b.l(xg1,yg1,xg2,yg2)=10;
c.l(manu,xg1,yg1) = 20;
quant.l(xg1,yg1,xg2,yg2) = 80000/91;
sold.l(manu,xg1,yg1) = 80000/4;
     LOOP(xg1$(ORD(xg1) EQ 1),
     LOOP(yg1$(ORD(yg1) LE 3),
      a.fx(xg1,yg1) = 0;
      b.fx(xg2,yg2,xg1,yg1) = 0;
      c.fx(manu,xg1,yg1) = 0;
      quant.fx(xg2,yg2,xg1,yg1)=0;
      sold.fx(manu,xg1,yg1) = 0;
     );
     LOOP(yg1$(ORD(yg1) GE 11),
      a.fx(xg1,yg1) = 0;
      b.fx(xg2,yg2,xg1,yg1) = 0;
      c.fx(manu,xg1,yg1) = 0;
      quant.fx(xg2,yg2,xg1,yg1)=0;
      sold.fx(manu,xg1,yg1) = 0;
     );
    );
     LOOP(xg1$(ORD(xg1) EQ 7),
     LOOP(yg1$(ORD(yg1) LE 3),
      a.fx(xg1,yg1) = 0;
      b.fx(xg2,yg2,xg1,yg1) = 0;
      c.fx(manu,xg1,yg1) = 0;
      quant.fx(xg2,yg2,xg1,yg1)=0;
      sold.fx(manu,xg1,yg1) = 0;
     );
     LOOP(yg1$(ORD(yg1) GE 11),
      a.fx(xg1,yg1) = 0;
```

```
    b.fx(xg2,yg2,xg1,yg1) = 0;
    c.fx(manu,xg1,yg1) = 0;
    quant.fx(xg2,yg2,xg1,yg1)=0;
    sold.fx(manu,xg1,yg1) = 0;
   );
  );
MODEL fert1 /all/;
OPTION IterLim = 100000000; OPTION ResLim = 10000000;
SOLVE fert1 USING RMIP minimizing totcost;
a.l(xg1,yg1) = CEIL(a.l(xg1,yg1));
b.l(xg1,yg1,xg2,yg2) = CEIL(b.l(xg1,yg1,xg2,yg2));
c.l(manu,xg1,yg1) = CEIL(c.l(manu,xg1,yg1));
SOLVE fert1 USING MIP minimizing totcost;
PARAMETER
totnodes;
totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
DISPLAY totnodes;
afcost=0;
rfcost=0;
adcost=0;
rdcost=0;
*POPULATION

*Western: rural 48, urban 4383; Central:
*rural 64, urban 6471; Eastern rural 80, urban 9687
LOOP(county,
IF ((ORD(county) EQ 1),
* western representative county
fertdemand(xg1,yg1) = 15675;
fertdemand('x4','y7') = 3922;
OPTION bratio = 0;
fert1.PriorOpt = 1;
fert1.TryInt = 1;
fert1.OptFile = 1;
*  OPTION optcr = 0.05;
SOLVE fert1 USING MIP minimizing totcost;
totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
DISPLAY totnodes;
);
IF ((ORD(county) EQ 2),
* central representative county
fertdemand(xg1,yg1) = 14308;
fertdemand('x4','y7') = 3580;
pop('rural') = 64;
pop('urban') = 6471;
rfcost = 0.11605003 * 2.135567784*0.001399515/1000000 *
```

```
                (4*SUM(road,pop(road)*miles(road))*938482);
rdcost = 0.41598848 *2.703575358*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);
  SOLVE fert1 USING MIP minimizing totcost;
  totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
  DISPLAY totnodes;
 );
 IF ((ORD(county) EQ 3),
* eastern representative county
  fertdemand(xg1,yg1) = 18443;
  fertdemand('x4','y7') = 4605;
  pop('rural') = 80;
  pop('urban') = 9687;
  rfcost = 0.11605003 * 2.135567784*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);
  rdcost = 0.41598848 *2.703575358*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);
  SOLVE fert1 USING MIP minimizing totcost;
  totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
  DISPLAY totnodes;
 );
);
* sensativity analysis on fixed costs
  fertdemand(xg1,yg1) = 14308;
  fertdemand('x4','y7') = 3580;
  fixed = 676500*1.5;
  rfcost = 0.11605003 * 2.135567784*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);
  rdcost = 0.41598848 *2.703575358*0.001399515/1000000 *
                (4*SUM(road,pop(road)*miles(road))*938482);
  SOLVE fert1 USING MIP minimizing totcost;
  totnodes = SUM((xg1,yg1),a.l(xg1,yg1));

 DISPLAY totnodes;
  fixed = 676500*0.5;
  SOLVE fert1 USING MIP minimizing totcost;
  totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
  DISPLAY totnodes;

* sensativity analysis on manufacturer transportation costs
  fixed = 676500;
  transd = transd*1.5;
  SOLVE fert1 USING MIP minimizing totcost;
  totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
  DISPLAY totnodes;
  transd = transd/1.5 * 0.5;
```

```
 SOLVE fert1 USING MIP minimizing totcost;
 totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
 DISPLAY totnodes;

* sensativity analysis on farmer transportation costs
 transd = transd/0.5;
 transf = transf * 1.5;
 SOLVE fert1 USING MIP minimizing totcost;
 totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
 DISPLAY totnodes;
 transf = transf/1.5 * 0.5;
 SOLVE fert1 USING MIP minimizing totcost;
 totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
 DISPLAY totnodes;

*sensitivity analysis with social costs doubled
 transf = transf/0.5;
 adcost = adcost*2;
 afcost = afcost*2;
 rdcost = rdcost*2;
 rfcost = rfcost*2
 SOLVE fert1 USING MIP minimizing totcost;
 totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
 DISPLAY totnodes;

*sensitivity analysis with social costs equal to 0
 adcost = 0;
 afcost = 0;
 rdcost = 0;
 rfcost = 0;
 SOLVE fert1 USING MIP minimizing totcost;
 totnodes = SUM((xg1,yg1),a.l(xg1,yg1));
 DISPLAY totnodes;
```